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Interim Measures Record of Decision

for

Operable Unit 3

Marine Corps Air Station

Cherry Point, North Carolina

Atlantic Division
Naval Facilities Engineering Command

Contract Number N62472-90-D-1298

Contract Task Order 0190

December 1996

Brown & Root Environmental

A Division of Halliburton NUS Corporation

06.04-12/01/96-0 1430

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INTERIM MEASURES RECORD OF DECISION
FOR
OPERABLE UNIT 3

MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Atlantic Division
Environmental Restoration Branch, Code 1823
Naval Facilities Engineering Command
1510 Gilbert Street
Norfolk, Virginia 23511-2699

Submitted by:
Brown & Root Environmental
993 Old Eagle School Road, Suite 415
Wayne, Pennsylvania 19087-1710

CONTRACT NUMBER N62472-90-D-1298
CONTRACT TASK ORDER 0190

DECEMBER 1996

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LIST OF ACRONYMS AND ABBREVIATIONS

ARAR	Applicable or Relevant and Appropriate Requirement
BGS	Below Ground Surface
CDI	Chronic Daily Intake
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CNO	Chief of Naval Operations
COPC	Chemical of Potential Concern
CSF	Cancer Slope Factor
DON	Department of Navy
DRMO	Defense Reutilization and Marketing Office
FMF	Fleet Marine Force
FS	Feasibility Study
FSSG	Force Service Support Group
HI	Hazard Index
HQ	Hazard Quotient
IAS	Initial Assessment Study
ICR	Incremental Cancer Risk
IRP	Installation Restoration Program
kg	Kilogram
L	Liter
MCAS	Marine Corps Air Station
MSL	Mean Sea Level
NADEP	Naval Aviation Depot
NCDEHNR	North Carolina Department of Environment, Health, and Natural Resources
NCGWQ	North Carolina Groundwater Quality Standard
NCP	National Contingency Plan
NPL	National Priorities List
NPW	Net Present Worth
O&M	Operation and Maintenance
OU	Operable Unit
PAH	Polynuclear Aromatic Hydrocarbon
POL	Petroleum, Oil, and Lubricants
PRAP	Proposed Remedial Action Plan

LIST OF ACRONYMS AND ABBREVIATIONS

ARAR	Applicable or Relevant and Appropriate Requirement
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IAS	Initial Assessment Study
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kg	Kilogram
L	Liter
MCAS	Marine Corps Air Station
MSL	Mean Sea Level
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NCDEHNR	North Carolina Department of Environment, Health, and Natural Resources
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O&M	Operation and Maintenance
OU	Operable Unit
PAH	Polynuclear Aromatic Hydrocarbon
POL	Petroleum, Oil, and Lubricants
PRAP	Proposed Remedial Action Plan

RBC	Risk Based Concentration
RCRA	Resource Conservation and Recovery Act
RfD	Reference Dose
RFI	RCRA Facility Investigation
RGO	Remedial Goal Option
RI	Remedial Investigation
RIIR	Remedial Investigation Interim Report
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SMP	Site Management Plan
SSL	Soil Screening Levels
STP	Sewage Treatment Plant
TBC	To Be Considered
TDM	Technical Direction Memorandum
UCL	Upper Confidence Level
μg	Microgram
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey

DECLARATION OF THE INTERIM MEASURES RECORD OF DECISION

DECLARATION

Site Name and Location

Operable Unit (OU) 3 consisting of the following RCRA Units: Site 6 (Fly Ash Ponds) and Site 7 (Old Incinerator and Adjacent Area).

Marine Corps Air Station
Cherry Point (Craven County), North Carolina

Statement of Basis and Purpose

This decision document presents the selected remedial action for OU3, Marine Corps Air Station (MCAS), Cherry Point, North Carolina. The remedy was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record for OU3, on comments received from the State of North Carolina during the public comment period, and on data collected during the pre-design phase of the fence construction.

The Department of the Navy and the Marine Corps have obtained concurrence from the State of North Carolina, Department of Environment, Health, and Natural Resources (NCDEHNR) and the United States Environmental Protection Agency (USEPA) Region IV on the selected remedy.

Assessment of the Site

Actual or threatened releases of hazardous substances from this operable unit, if not addressed by implementing the response action selected in this Interim Measures Record of Decision (ROD), may present a potential threat to public health, welfare, or the environment.

Description of Selected Remedy

The selected remedy for OU3 is Institutional Controls at both Sites 6 and 7 (Alternative 2), natural attenuation of groundwater contaminated with fuel-related compounds at Site 7, and enhanced bioremediation of an isolated area of soil contaminated with fuel-related compounds at Site 7.

The major components of the selected remedy include:

- Maintaining records of the contamination at OU3 in the MCAS Cherry Point Base Master Plan. The records of the presence of contamination at OU3, recorded in the Air Station's Base Master Plan, will ensure that, at the time of future land development, MCAS Cherry Point will be able to take adequate measures to minimize adverse human health and environmental effects.

- Land use restrictions that will limit the future use of land at OU3, including the placement of water wells at OU3. The restrictions will be implemented via the Air Station's Base Master Plan, with the concurrence of USEPA and NCDEHNR.

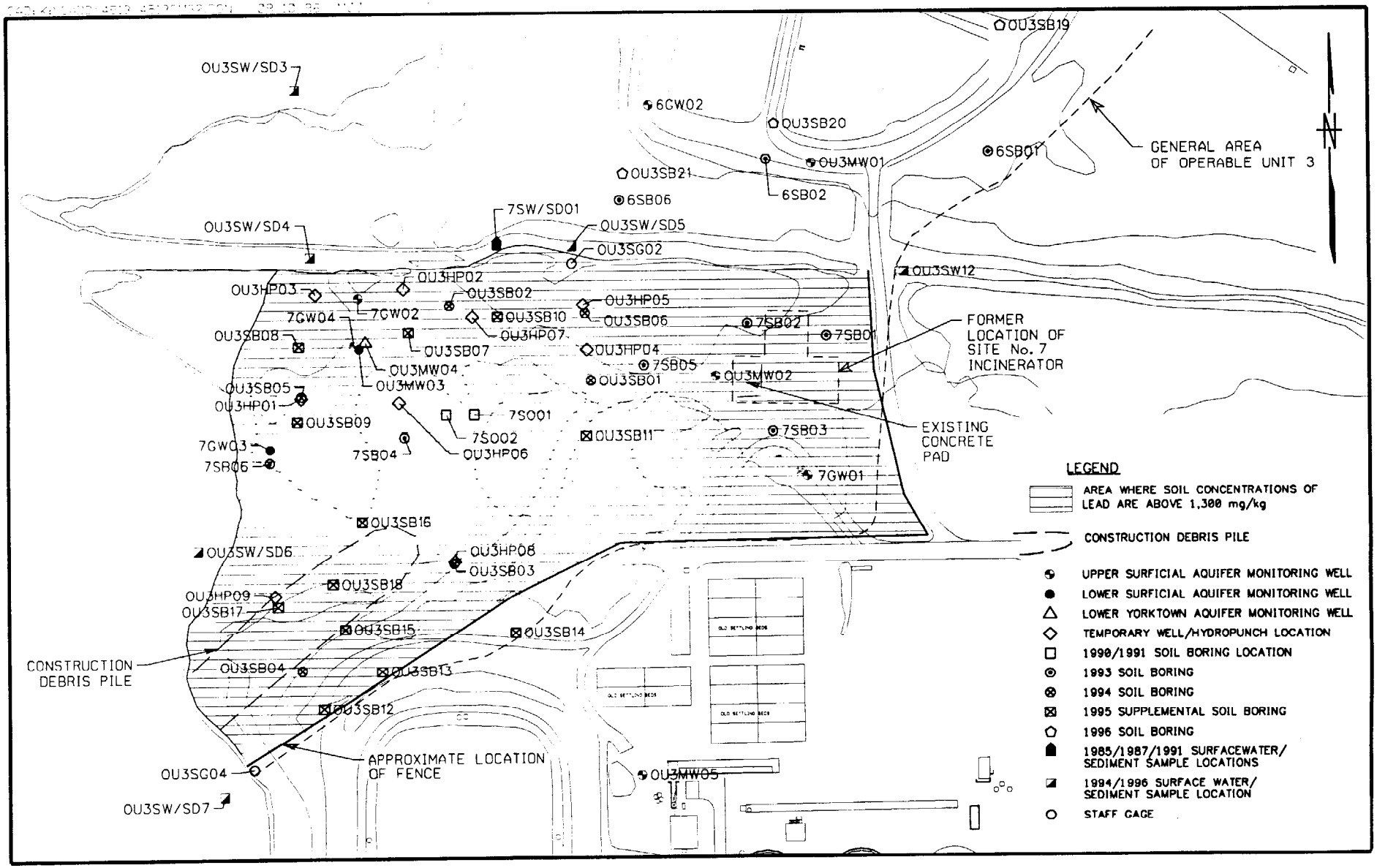
- Aquifer use restrictions that will prohibit the future use of the groundwater under OU3 as a water source. The restrictions will also be implemented via the Air Station's Base Master Plan, with the concurrence of USEPA and NCDEHNR.

- The placement of fencing and warning signs at Site 7 to prevent access to soils with lead concentrations above acceptable levels (see Figure 1 for the location of the fence).

- A long-term monitoring plan in which groundwater, soil, surface water, and sediment samples are collected and analyzed to assess contaminant migration. The monitoring plan will also assess the progress of the natural attenuation of the groundwater and the bioremediation of the soil. The monitoring plan will be prepared in accordance with Federal and State regulations, and with the concurrence of USEPA and NCDEHNR.

- Natural attenuation of the groundwater contaminated with fuel-related compounds at Site 7.

- Enhanced in-situ bioremediation of an isolated area of soil contaminated with fuel-related compounds.



ESTIMATED EXTENT OF SOIL CONTAMINATED WITH LEAD
SITE 7, OU3
MCAS CHERRY POINT, NORTH CAROLINA

FIGURE 1

0 150 300
SCALE IN FEET

Brown & Root Environmental

REVISION 1
DECEMBER 1996

The selected remedy addresses the principal threats associated with exposure to the soil/waste fill material and to the groundwater within the surficial aquifer at OU3.

Statutory Determinations

The selected remedy will provide protection of human health by preventing exposure to potential soil contaminants and buried wastes at OU3 through institutional controls (land use restrictions), construction of fencing along Site 7, and the posting of warning signs. Institutional controls will also provide protection of human health by preventing exposure to potential groundwater contaminants by prohibiting the installation of any wells at OU3 (other than for monitoring purposes).

The selected remedy also provides a measure of protection for the environment by addressing the secondary sources of groundwater contamination (contaminated soil), which may expedite the natural attenuation of the groundwater.

Fencing, warning signs, institutional controls (land use and groundwater use restrictions), control of secondary sources of contamination, and monitoring provide a cost-effective remedy, since there are minimal costs associated with their implementation. The environmental monitoring program included under the selected remedy is also cost effective compared to other treatment/disposal alternatives, which would provide limited additional protection at a significantly higher cost.

The selected alternative would provide permanent, long-term remedies through provision and enforcement of institutional controls in the Air Station's Base Master Plan to limit access, restrict future land use, and prohibit use of groundwater. The selected alternative would also provide permanent, long-term remedies by addressing the secondary sources of groundwater contamination.

The statutory preference for treatment is not satisfied because minimal active treatment is necessary at OU3 to maintain adequate protection of human health and the environment. The other treatment/disposal alternatives evaluated for OU3 were not considered to be cost effective with respect to the additional protection provided.

Because this remedy will result in hazardous substances remaining on site in concentrations above health-based levels, 5-year reviews will be required to ensure that the remedy continues to provide adequate protection of human health and the environment.

_____
Signature (Commanding General,
USMC, MCAS Cherry Point)

_____ _____
Date Date

1.0 SITE NAME, LOCATION, AND DESCRIPTION

Marine Air Corps Station (MCAS) Cherry Point is part of a military installation located in southeastern Craven County, North Carolina, just north of the town of Havelock. The site is located on an 11,485-acre tract of land bounded on the north by the Neuse River, on the east by Hancock Creek, and on the south by North Carolina Highway 101. The irregular western boundary line lies approximately three-quarters of a mile west of Slocum Creek. The general location of the Air Station is shown on Figure 1-1.

The study area, Operable Unit (OU) 3, is one of 13 operable units located within MCAS Cherry Point. An "operable unit," as defined by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), is a discrete action that comprises an incremental step toward comprehensively addressing site problems. With respect to MCAS Cherry Point, operable units were developed to combine one or more individual sites where Installation Restoration Program (IRP) activities are or will be implemented.

Operable Unit 3 is located in the west central portion of the Air Station on the east bank of Slocum Creek, as shown on Figure 1-2. It is bounded by the MCAS Cherry Point Sewage Treatment Plant (STP) to the south, Roosevelt Boulevard to the east, Slocum Creek Road to the north, and Slocum Creek to the west (Figure 1-3). OU3 consists of two sites:

- Site 6 - Fly Ash Ponds
- Site 7 - Old Incinerator and Adjacent Area

These sites have been grouped into one operable unit because of their proximity to each other.

1.1 SITE 6 - FLY ASH PONDS

Site 6 consists of three unlined ponds located south of Slocum Road. The ponds cover about 2.5 acres and are about 10 feet deep. Site 6 reportedly received a slurry of fly ash and cinders from the old power plant located across Slocum Creek Road from the 1940s until about 1970. The ponds were then reportedly used for the disposal of lime/alum sludge from the potable water treatment plant from December 1980 to mid-1994. During the time the ponds were used for the disposal of lime/alum sludge, each of the ponds was dredged on an annual basis. At the current time, no disposal activities occur at the site, as the lime/alum sludge is not generated by the new water treatment plant, which went on-line in 1994. Residual lime/alum sludge (and sometimes rainwater) may exist in the ponds.

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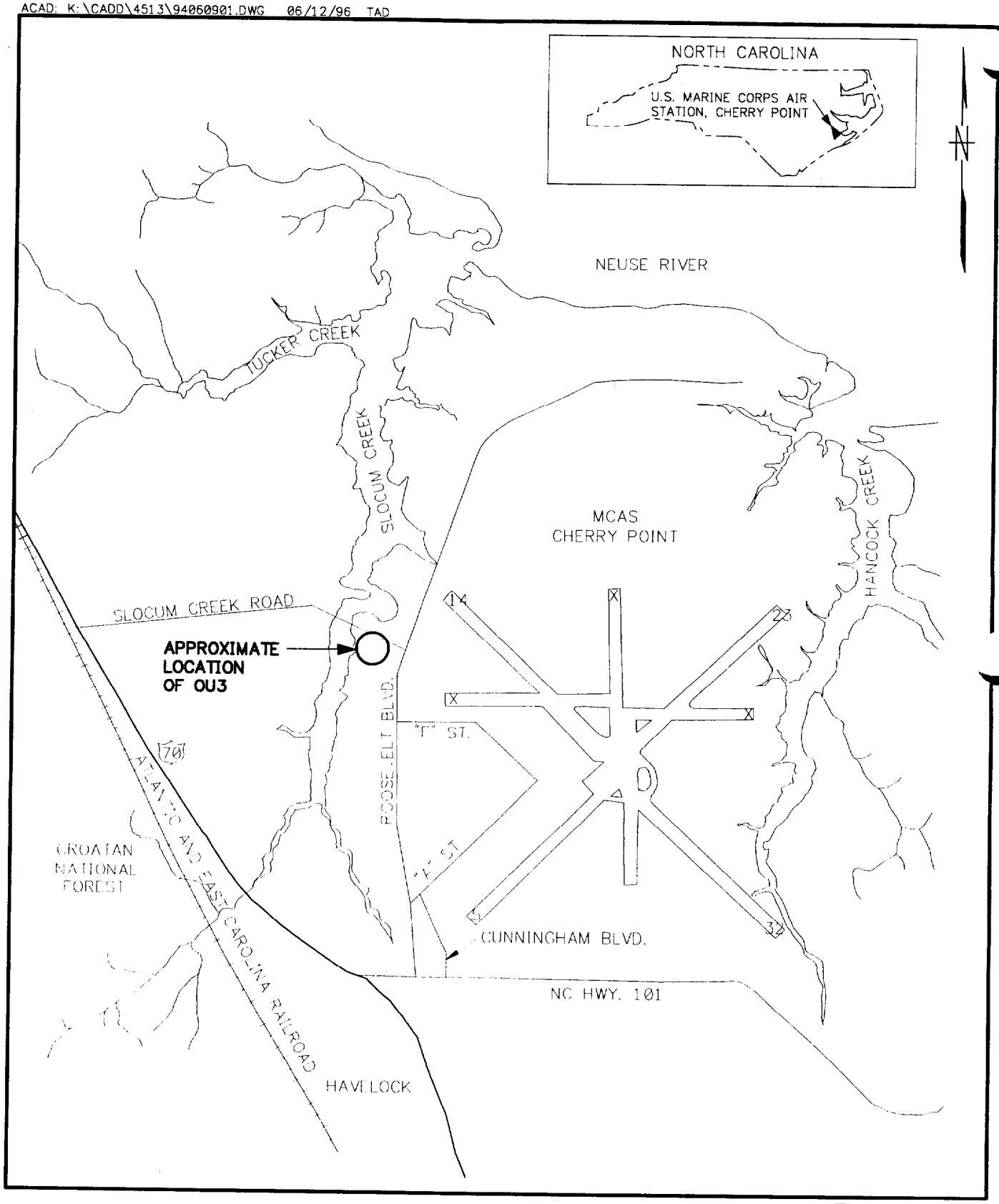

FIGURE 1-1

LOCATION MAP
MCAS – CHERRY POINT, NC

0 4500 9000
SCALE IN FEET

Brown & Root Environmental

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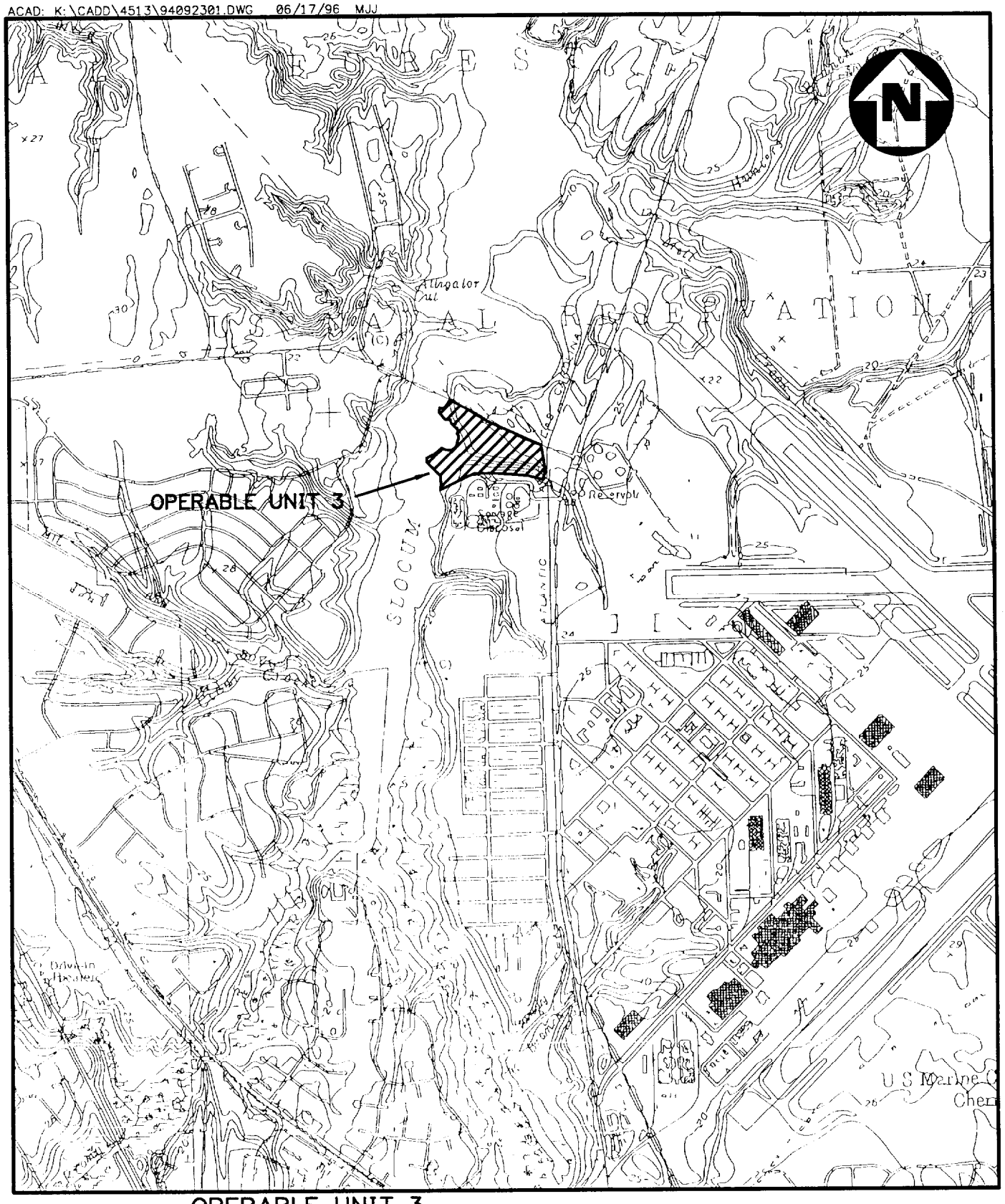

OPERABLE UNIT 3
GENERAL AIR STATION MAP
MCAS CHERRY POINT, NORTH CAROLINA

0 2000 4000
SCALE IN FEET

FIGURE 1-2

Brown & Root Environmental

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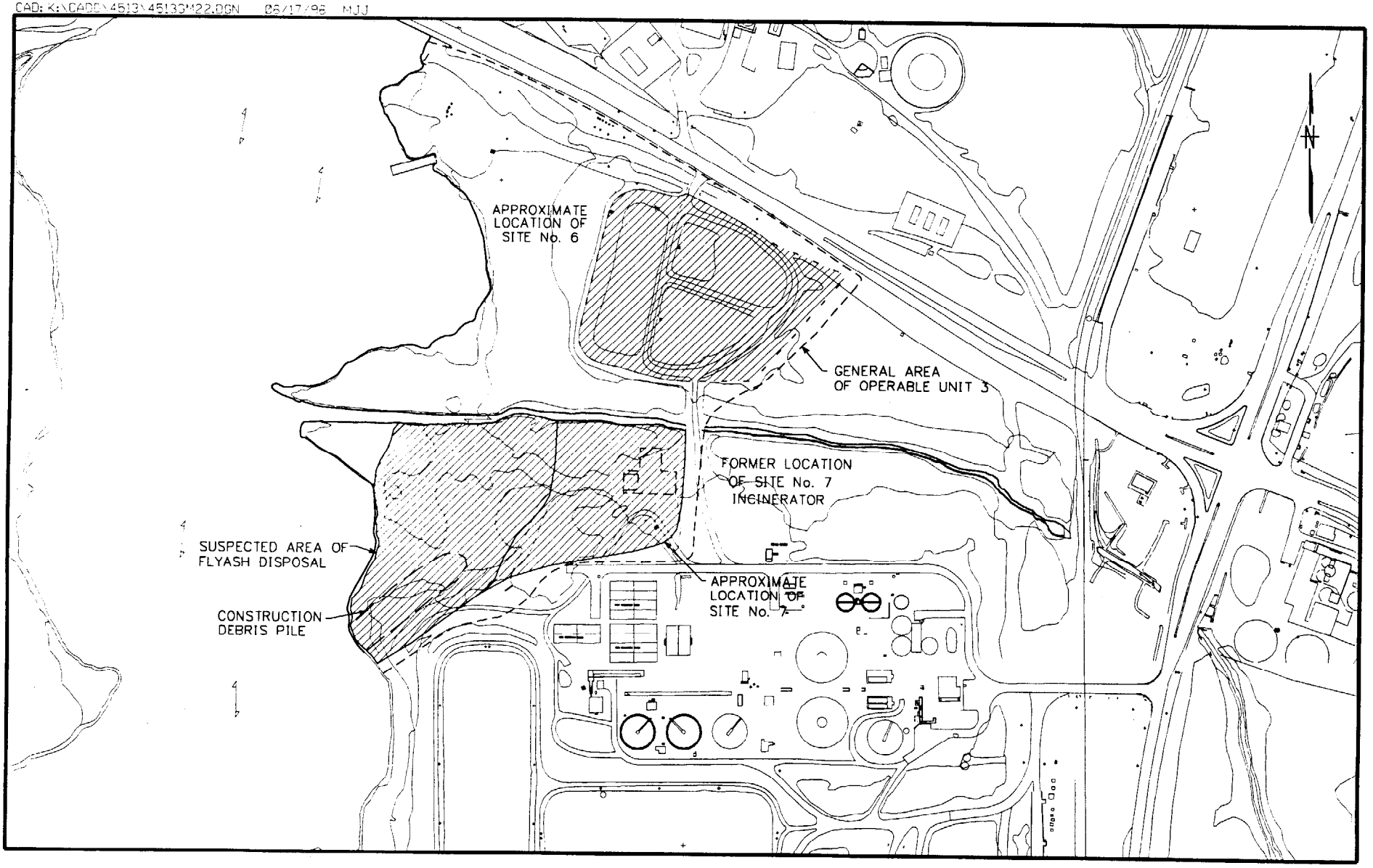

SITE LAYOUT MAP
OU3
MCAS CHERRY POINT, NORTH CAROLINA

0 300 600
SCALE IN FEET

FIGURE 1-3

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1.2 SITE 7 - OLD INCINERATOR AND ADJACENT AREA

Site 7 was an incinerator and open burning ground that covered approximately 5 acres. It is bounded by the sewage treatment plant, Luke Rowe's Gut, and Slocum Creek. From 1949 until 1955, waste petroleum, oil, and lubricants (POL), Naval Aviation Depot (NADEP) wastes, and other wastes such as municipal refuse were burned either in the incinerator or on the ground adjacent to the unit. No records were kept as to the types or quantities of waste disposed at this unit. Fly ash was disposed of at this site but is mixed with other waste/fill material. The fly ash is believed to have originated from the incinerator itself. The site is currently vegetated with grass, brush, and trees with the heaviest vegetation along the stream banks.

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

2.1 SITE HISTORY

The MCAS Cherry Point mission is to maintain and support facilities, services, and materiel of a Marine Aircraft Wing, or units thereof, and other activities and units as designated by the Commandant of the Marine Corps in coordination with the Chief of Naval Operations (CNO). Occupants at the Air Station include the Second Marine Aircraft Wing (2nd MAW), the Naval Aviation Depot (NADEP), the combat Service Support Detachment 21 of the Second Air Force Service Support Group (2nd FSSG), the Naval Hospital, the Dental Clinic, the Naval Air Maintenance Training Group Detachment, and the Defense Reutilization and Marketing Office (DRMO). The Air Station has facilities for training and support of the Fleet Marine Force (FMF) Atlantic aviation units and is also designated as a primary aviation supply point.

The Air Station was commissioned in 1942. Continuing construction in 1943 added a massive aircraft assembly and repair shop, which later became the NADEP. During the 1950s and 1960s, the size of the Air Station increased from 7,582 acres to more than 11,000 acres (not including outlying facilities) as a result of land acquisitions. During the 1970s, commercial and residential development of the surrounding area grew substantially. In 1980, the City of Havelock annexed MCAS Cherry Point.

The northern portion of OU3 (Site 6) consists of three unlined ponds located south of Slocum Creek Road. The ponds cover about 2.5 acres and are about 10 feet deep. Site 6 reportedly received a slurry of fly ash and cinders from the old power plant located across Slocum Creek Road from the 1940s until about 1970. Aerial photographs of the site indicate that the existing ponds were not constructed until the late 1950s, when two ponds were constructed, but earlier photographs indicate the presence of a natural pond and/or shallow depressions. A third pond appears in the 1978 aerial photographs. The ponds were then reportedly used for the disposal of lime/alum sludge from the potable water treatment plant from December 1980 to mid-1994. During the time the ponds were used for the disposal of lime/alum sludge, each of the ponds was dredged on an annual basis. Each event resulted in the removal of approximately 5,000 cubic yards of sludge from each pond. The material was hauled away by contract. No specific destination was identified in the contracts, but the majority of the material was reportedly sent to local large corporation farms. At the current time, no disposal activities occur at the site because the lime/alum sludge is not generated by the new water treatment plant, which went on-line in 1994. Residual lime/alum sludge (and sometimes rainwater) may exist in the ponds.

The southern half of OU3 (Site 7) was an incinerator and open burning ground that covered approximately 5 acres. It is bounded by the STP, Luke Rowe's Gut, and Slocum Creek. From 1949 until 1955, waste petroleum, oil, and lubricants (POL), NADEP wastes, and other wastes such as municipal refuse were burned either in the incinerator or on the ground adjacent to the unit. No records were kept as to the types or quantities of waste disposed at this unit. Fly ash was disposed of at this site but is mixed with other waste/fill material. The fly ash is believed to have originated from the incinerator itself. The aerial photographs of Site 7 indicate that the incinerator itself was not removed until some time between 1981 and 1984.

2.2 PREVIOUS INVESTIGATIONS AND ENFORCEMENT ACTIVITIES

Operable Unit 3 has been under investigation since 1984. The OU3 sites (6 and 7) were identified in the Initial Assessment Study (IAS) prepared by a Department of Navy (DON) contractor. These sites were also included in a multi-task Resource Conservation and Recovery Act (RCRA) Section 3008(h) Administrative Order on Consent signed by the DON and the United States Environmental Protection Agency (USEPA) in December 1989. MCAS Cherry Point was placed on the National Priorities List (NPL) in December 1994. The sites included in OU3 are now managed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); however, the RCRA Section 3008(h) Administrative Order on Consent is still in effect. The State of North Carolina holds a RCRA permit with MCAS Cherry Point which incorporates the Administrative Order on Consent. Consequently, the 32 SWMUs identified in the Administrative Order on Consent are incorporated into the State's RCRA permit.

The investigations at OU3 were conducted using a phased approach that was based on the availability of funding and the prioritization of sites in terms of potential environmental impacts. The work was conducted under several environmental programs according to regulatory requirements in effect at the time. Information pertaining to these investigations is contained in the following documents:

- Remedial Investigation Interim Report (RIIR), October 1988 (NUS Corporation).
- RCRA Facilities Investigation (RFI) - 21 Units, June 1993 (Halliburton NUS Environmental Corporation).
- Technical Direction Memorandum (TDM) - 10 Units, August 1993 (Halliburton NUS Corporation).

- Remedial Investigation (RI) Report for Operable Unit 3, Brown & Root Environmental, December 1996.

- Feasibility Study (FS) Report for Operable Unit 3, Brown & Root Environmental, December 1996.

No enforcement activities, removal actions, or remediation activities have been initiated at OU3.

3.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION

The RI/FS and Proposed Remedial Action Plan (PRAP) documents for OU3 were released to the public on August 1, 1996. These documents were made available to the public in an administrative record file and in information repositories maintained at the Havelock Public Library and the MCAS Cherry Point Library. The notice of the availability of these documents was published in the Havelock News on July 31, 1996; the Windsock on August 1, 1996; the Carteret County News - Times on July 28, 1996; and the Sun Journal on July 28, 1996. A public comment period was held beginning on August 1, 1996. In addition, a public meeting was held on August 22, 1996. At this meeting, representatives from the DON and MCAS Cherry Point answered questions about problems at the site and the remedial alternatives under consideration. A response to the comments received during the public comment period is included in the Responsiveness Summary, which is part of this Record of Decision (Section 14). This decision document presents the selected remedial action for OU3, MCAS Cherry Point, North Carolina, chosen in accordance with applicable Federal and state regulations, and the NCP. The decision for OU3 is based on the Administrative Record, on comments received from the State of North Carolina during the Public Comment period, and on data collected during the pre-design phase of the fence construction.

4.0 SCOPE AND ROLE OF OPERABLE UNIT 3

Thirteen operable units were defined at MCAS Cherry Point based on contaminant similarity, source similarity, and/or physical proximity of the contaminated sites. OU3 includes the contaminated soils, sediments, surface waters, and groundwater in the areas of the Fly Ash Ponds (Site 6) and the Old Incinerator and Adjacent Area (Site 7). One operable unit, OU12, has been deferred to the State of North Carolina's underground storage tank program. The remaining operable units at the MCAS are being investigated as part of a comprehensive Air Station investigation. The timing and co-ordination of these investigations have been addressed in the MCAS Cherry Point Site Management Plan (SMP).

The potential exposure to contaminated soil and groundwater under a future residential exposure scenario constitutes the principal risks to human health at OU3. In addition, the hypothetical exposure of construction workers to contaminated soil and groundwater at Site 7 also produces risks to human health. The selected remedy identified in this Decision Summary for contaminated soil and groundwater at OU3 will eliminate or minimize risks to human health and the environment.

5.0 SITE CHARACTERISTICS

MCAS Cherry Point is located in the Coastal Plain of North Carolina. Ground surface elevations range from 17 feet to 20 at the highest points at Sites 6 and 7, respectively, to approximately 1.5 feet at the banks of Slocum Creek.

Operable Unit 3 is bounded on the west by Slocum Creek, which flows northward past the site. Luke Rowe's Gut is a perennial stream that flows between Sites 6 and 7 into Slocum Creek. Luke Rowe's Gut is a freshwater body, whereas Slocum Creek is a tidal saltwater body. The soils at the site are generally poorly drained and acidic. They are also subject to ponding and seasonal high water tables. Low-lying areas along the streams are subject to flooding.

The knowledge of the stratigraphy at OU3 is derived from published U.S. Geological Survey (USGS) documents and the onsite boring logs. The surficial material at OU3 consists of both natural material (sand, silt, and clay) mixed with fill (black silty fly ash, charred wood, metal fragments, and glass fragments). Natural material at OU3 consists of yellow brown and grey silty sand with local peat deposits and is generally found to be 25 feet thick.

At Site 6, a 2-foot-thick, black silt layer believed to be fly ash was encountered beneath a 2-foot-thick layer of soft grey silt and clay (lime/alum sludge), below two of the fly ash (lime/alum sludge) ponds. Black fly ash was also found in borings in the berms and around the perimeter of the ponds and in the OU3MW06 well boring, located 100 feet east of the ponds.

Site 7 is divided into two portions, with the western portion of Site 7 being the suspected area of fly ash disposal and open burning (as shown on Figure 1-3). The eastern portion, although not used as extensively for fly ash disposal as the western portion, also had fly ash deposited in places. At Site 7, a black fill material was encountered from the ground surface to a depth of 10 feet below ground surface (BGS) in three soil borings believed to approximate the boundary separating the suspected area of fly ash disposal and open burning from the remaining portion of the site. Because soil borings were terminated at the water table, the full vertical extent of fill material is not known at these particular locations. However, based on other borings at Site 7, up to 15 feet of fill material may be present. Fly ash was also found in some of the soil borings on the eastern portion of the site.

The surficial aquifer is the uppermost aquifer of the study area and is exposed at the ground surface and in streambeds throughout the Air Station. This aquifer consists of unconsolidated and interfingering beds of fine sand, silt, clay, shell, and peat beds, as well as scattered deposits of coarser-grained material believed to represent relic beach ridges and alluvium. Groundwater beneath OU3 was encountered in the surficial aquifer at approximately 2 to 10 feet BGS, and water-level elevations ranged from approximately 1.35 to 7.46 feet mean sea level (MSL).

The groundwater in the surficial aquifer flows toward and discharges into either Slocum Creek or Luke Rowe's Gut. The lime/alum sludge ponds at Site 6 are unlined and act as a recharge zone for the surficial aquifer, the result of which is a mounding of the water table in this area. The groundwater flows in a radial pattern away from the ponds toward Slocum Creek and Luke Rowe's Gut.

Underlying the surficial aquifer is the Yorktown confining unit. It consists of an olive green to grayish green, dense, fine sand with varying amounts of shell fragments, clay, and silt. One boring was extended through this confining unit to install a monitoring well in the Yorktown aquifer. The confining unit was 21 feet thick at this location. The Yorktown aquifer is described as a gray, silty sand with varying amounts of shell fragments. A dark green, clayey silt and clayey sand were encountered in this Lower Yorktown well at a depth of 68 feet. These materials signify the presence of the underlying Pungo River confining unit. The thickness of this confining unit was not determined because the unit was not penetrated during the drilling activities.

Potable water used at the Air Station and in the adjacent town of Havelock comes from the Castle Hayne aquifers. These aquifers lie at depths of approximately 195 feet or more below ground surface, below the Pungo River aquifer and the Castle Hayne confining unit. All groundwaters at the Air Station, including the surficial aquifer, are classified as GA waters by the state of North Carolina. Such groundwater is considered to be an existing or potential source of drinking water.

The state surface water classification for Slocum Creek is Class SC saltwater. Class SC waters are classified as suitable for aquatic life propagation and maintenance of biological integrity, wildlife, secondary recreation, and any other usage except primary recreation or shellfishing for marketing purposes. The state surface water classification for Luke Rowe's Gut is Class C freshwater. Class C waters are classified as suitable for aquatic life propagation and maintenance of biological integrity, wildlife, secondary recreation, agriculture, and any other usage except for primary recreation or a source of water supply for drinking, culinary, or food processing purposes.

The Air Station has an active fish and wildlife management program designed to protect all native wildlife species and their habitat, make fish and wildlife resources available on a continuing basis, and enhance fish

and wildlife resources. Numerous game and nongame species exist at the Air Station. Slocum Creek and its tributaries are designated by the North Carolina Natural Heritage Program (NCNHP) as a critical environmental area that is considered to be essential to the conservation and management of rare species (both state and Federal). In addition, the Air Station has management programs for endangered and threatened species known to exist at or migrate through the area. These include the bald eagle, American alligator, red-cockaded woodpecker, and loggerhead turtle.

The Air Station also runs an active fisheries management program to provide recreational fishing for personnel and their dependents, civilian employees, and public guests. The program consists of intensive management of four freashwater ponds, as well as regulation enforcement on adjacent waters.

6.0 NATURE AND EXTENT OF CONTAMINATION

Soil, groundwater, surface water, and sediment samples were collected and analyzed for a variety of parameters to determine the nature and extent of contamination at OU3.

For Site 6, chemical analytical data indicate that this area has been relatively unaffected by incineration/burning and fly ash disposal activities. The data appear to confirm the assumption that when the quenching ponds were dredged a final time prior to use as lime/alum sludge ponds, most of the fly ash was removed. However, minimal residual material does remain on site.

The major contamination issues at OU3 center on Site 7, which is the location of the former incinerator and fly ash disposal area. At Site 7, south of Luke Rowe's Gut, the soil and groundwater have exhibited some effects from the waste disposal activities that occurred there.

6.1 SOIL

The concentrations of contaminants found in the surface soil were much higher at Site 7 than they were at Site 6. Overall, polynuclear aromatic hydrocarbons (PAHs), were prevalent surface soil contaminants at Site 7. Dioxins and furans were also detected in several surface soil samples. The congeners detected include only the least toxic of the chlorinated di-benzo-p-dioxins. Volatile organic compounds, other semi-volatile organic compounds, pesticides, and PCBS were also detected in surface soils at Site 6 and Site 7. Metals were more frequently detected than organics in the surface soil at Site 6 and Site 7. The concentrations detected at Site 7 were generally above the background concentrations with the maximum concentration for the majority of the metals detected in the fly ash disposal area.

As with the surface soils, the concentrations of contaminants detected in the subsurface soil were much higher at Site 7 than at Site 6. Minimal organic contamination was noted at Site 6 in the subsurface soil samples. The concentrations of metals beneath the ponds in the black silty soil materials and in the surrounding natural soils were fairly similar.

On the south side of Luke Rowe's Gut, the soils are distinctly different in contamination profiles. The maximum concentration for a number of organic and for all of the inorganic analytes were detected at concentrations above the range of background concentrations. A soil boring, located on the eastern edge of the identified disposal area contained the highest concentrations of several volatile and semivolatile

organic compounds. These volatile organic compounds include benzene (6,600 µg/kg), ethylbenzene (61,000 µg/kg), and xylenes (63,000 µg/kg). This sample also contained 2-methylnaphthalene (77,000 µg/kg) and naphthalene (38,000 µg/kg). These compounds are relatively soluble PAHs that are found in various fuels. This sample was collected just above the water table surface, and the results appear to indicate that a small spill of gasoline, or other fuels, may have occurred in this area. During sampling, this sample was noted to have a petroleum odor and visual observation of water collected in this boring during the ecological assessment indicated the presence of a fuel sheen. It is likely that during the use of the site as an incinerator/burning area, gasoline, or other fuels, may have been used to start a fire. This sample location is approximately 50 feet from Luke Rowe's Gut, and the surface water samples collected in that vicinity do not contain fuel components, nor was a sheen noted on the water surface. Therefore, it may be concluded that this is an isolated occurrence.

Again, PAHs were the most prevalent soil contaminants at Site 7, detected in up to half of the subsurface soil samples. Concentrations ranged from 23 to 77,000 µg/kg. However, the maximum concentrations of most PAHs were found in one boring in the 0- to 2-foot depth interval. This sample is located in the southeastern portion of the fly ash disposal area.

The concentrations of many metals in the subsurface soil at Site 7 were similar to those found in the surface soils. Some metals such as barium, copper, and vanadium were found at higher concentrations in the surface than in the subsurface, whereas other metals such as antimony, arsenic, beryllium, chromium, mercury, and silver exhibited the opposite trend. Some of the metals, including antimony, arsenic, chromium, cadmium, cobalt, lead, manganese, mercury, nickel, and zinc, were detected in multiple subsurface soil samples at concentrations greater than reported background concentrations. The data indicate that these metals are not found in excess concentrations in the adjacent sediments.

In general, the results for Site 7 indicate that this was an area of significant waste disposal activity, and the suite of contaminants (metals, PAHs, and dioxins) indicate that fly ash was emplaced here and that open burning probably occurred in localized areas. The concentrations of many of the "heavy" metals exceed those reported in the background soil samples.

6.2 GROUNDWATER

Groundwater analytical data indicate that since 1991, benzene has consistently been detected in samples from a single well at Site 7. Benzene was also detected in several temporary wells, as well as in a few soil samples. Other fuel-related compounds detected in the groundwater samples included xylenes (at concentrations below 1 µg/L), 2-methylnaphthalene (at concentrations up to 18 µg/L), and naphthalene (at

3 μg/L) . Groundwater from the location of the highest benzene concentrations discharges directly into Slocum Creek, and no fuel-related compounds or sheens were noted in the creek.

A few other organic compounds were detected in temporary wells installed at Site 7, including halogenated aliphatics, 1,2-dichlorobenzene, chlorobenzene, and carbon disulfide, as well as some PAHs and pentachlorophenol. Bis(2-ethylhexyl)phthalate was detected in five groundwater samples at Site 7.

Iron and manganese were detected in a majority of the wells at both Site 6 and Site 7. Barium, cadmium, and lead were sporadically detected in the groundwater at Site 7.

Comparing the groundwater results with the North Carolina standards for groundwater indicated that iron (an aesthetic-based standard) exceeded the State's standard in almost every well. The manganese standard of 50 μg/L (an aesthetic-based standard) was also exceeded in every well at Site 7 and one well at Site 6. At Site 7, benzene was commonly found at concentrations above the State's standard of 1 μg/L (1 permanent and 5 temporary wells). The 2-methylnaphthalene standard was exceeded in one permanent and two temporary wells at Site 7, whereas the 4,4'-DDT standard was exceeded in one permanent well at each Site. Bis(2-ethylhexyl)phthalate was detected above the State's standard in two wells at Site 7. Other organics (vinyl chloride, pentachlorophenol, dieldrin, and endosulfan I) were found to exceed standards in only one well each. Barium and cadmium were detected at concentrations over the State's standards only once, and lead was found to exceed standards in two temporary wells at Site 7. No exceedances of groundwater standards were noted in the Yorktown aquifer.

6.3 SURFACE WATER

The analytical data for Luke Rowe's Gut and Slocum Creek indicate that low concentrations of trihalomethanes were detected in both water bodies. The presence of these compounds in the surface waters (and not in groundwater) is most likely related to the adjacent wastewater treatment plant, and potentially some inadvertent release from treated water lines. Samples from Luke Rowe's Gut also contained phthalate esters in one of the more upstream samples. Compounds that exceeded the State's surface water standards in the unfiltered samples collected in 1994 included bis(2-ethylhexyl)phthalate (Luke Rowe's Gut) and mercury (Luke Rowe's Gut and Slocum Creek). Compounds that exceeded the State's surface water standards in the filtered samples collected in 1994 included copper (Luke Rowe's Gut and Slocum Creek) and chromium and nickel (Slocum Creek).

6.4 SEDIMENT

The sediment analytical data for Luke Rowe's Gut and Slocum Creek indicate that the compounds detected most often in onsite soils at elevated concentrations (PAHs, dioxins, lead, copper, zinc, etc.) are not detected in the stream sediments at concentrations that would otherwise indicate a significant runoff problem in this area. Most of the metals were found at concentrations that are more typical of background soil concentrations.

7.0 CONTAMINANT FATE AND TRANSPORT

The most prevalent contaminants at OU3 are PAHs and metals in soils, and benzene, bis(2-ethylhexyl)phthalate, 2-methylnaphthalene, and metals in groundwater. In addition, low concentrations of a few other volatile organics were also detected in one temporary well, whereas low concentrations of some pesticides were detected in two wells. Pesticides were also detected in the sediment.

PAHs are generally considered to be fairly immobile chemicals in the environment. They are large molecules with high organic carbon partition coefficients and low solubilities when compared to the volatile organics. These compounds, when found in the surface soil, generally do not migrate vertically to a great extent. Instead, they are more likely to adhere to soil particles and be removed from the site via surface runoff and erosional processes. At OU3, the ground surface is fairly flat and well vegetated, and the PAHs detected in the surface soil do not appear to have migrated off site to the sediments, although fluoranthene was detected in one sediment sample in Slocum Creek.

Several PAHs (benzo(k)fluoranthene, fluoranthene, 2-methylnaphthalene, naphthalene, phenanthrene, and pyrene) were detected in subsurface soils. The highest concentrations, however, were generally detected in soil samples collected from a depth of 0 to 2 feet. Three of the most soluble PAHs (2-methylnaphthalene naphthalene, and phenanthrene) were detected at the highest concentrations (up to 77,000 μg/kg), whereas other PAHs were detected at somewhat lower concentrations. The highest concentrations are found in a soil sample associated with high benzene, ethylbenzene, and xylenes concentrations, as well. These results may indicate a small fuel release, or a fire (open burning) started with gasoline or other fuel.

2-Methylnaphthalene (18 μg/L), acenaphthene (1 μg/L), naphthalene (3 μg/L) and pyrene (0.6 μg/L) were the only PAHs detected in the groundwater samples. Because 2-methylnaphthalene is one of the more soluble PAHs and may be associated with benzene, its presence may also be related to another small fuel release, or open burning.

Because metals are frequently incorporated into the soil matrix and remain bound to particulate matter, they also migrate from the source areas via bulk movement processes (erosion). The larger particles (> 0.45 microns, which are not removed via the filtration step prior to water analysis) are not generally considered to be mobile in groundwater. The metals detected in early unfiltered groundwater samples are likely to be representative of suspended soil material in the samples.

There are some instances, however, where these metals are found at such concentrations or in such form as to be able to migrate in solution. It is possible that industrial activities could saturate all available exchange sites in soil and hence a metal may be mobilized. Metals are also more mobile under acidic conditions, which may exist in areas where certain industrial activities have occurred. Finally, a metal solution may be used in some industrial applications. In these cases, it is possible for metals to migrate vertically through the soil column and reach the groundwater, although such activities did not occur at OU3. However, at OU3, the concentrations of toxic metals were low (below drinking water standards) or not detected in groundwater even though high concentrations were noted in soil. Lead, copper, and zinc, in particular, were noted in multiple soil samples (from the former incinerator/fly ash disposal area) at concentrations above background, but were essentially not detected in groundwater when the low-flow sampling techniques were used.

Volatile organic chemicals (VOCs) are typically considered to be fairly soluble and have a low capacity for retention by soil organic carbon. Therefore, VOCs are the organic compounds most likely to be detected in groundwater. These types of chemicals may migrate through the soil column after being released by a spill event as infiltrating precipitation solubilizes them. Some portion of these chemicals is retained by the unsaturated soil, but most will continue migrating downward until they reach the water table.

Several of the VOCs have specific gravities less than that of water (e.g., benzene, xylenes). These compounds are typically found in fuels, and if a large enough fuel spill occurs (including open burning and using gasoline, etc., as a fuel), these compounds may move through the soil column as a bulk liquid, until they reach the water table. There, instead of going into solution, the majority of the release may remain as a discrete fuel layer on the water table surface, with some of the material going into solution at the water/fuel interface. Although benzene was detected in six monitoring wells, no floating fuel product was observed in any permanent or temporary monitoring wells, even though water collected in one soil boring at Site 7 exhibited an oily sheen. This oily sheen indicates that fuel constituents are entering the groundwater. The water table over much of the study area is less than 5 feet deep, and only two soil samples contained notable concentrations of these fuel-related constituents, whereas several soil samples contained low concentrations of these compounds. A temporary well installed downgradient of the contaminated soil area contained 15 μg/L benzene, but no fuel sheens were observed in Luke Rowe's Gut in this general area.

Like the PAHs, pesticides as a class of compounds are not considered to be very mobile in the environment. These chemicals, upon application or disposal, tend to remain affixed to soil particles. Migration of pesticides occurs primarily by erosion via the action of wind or water. However, the flat terrain and thick vegetation have minimized migration of pesticides. Concentrations of pesticides in soils and sediments at OU3 are generally below 10 μg/kg.

8.0 SUMMARY OF SITE RISKS

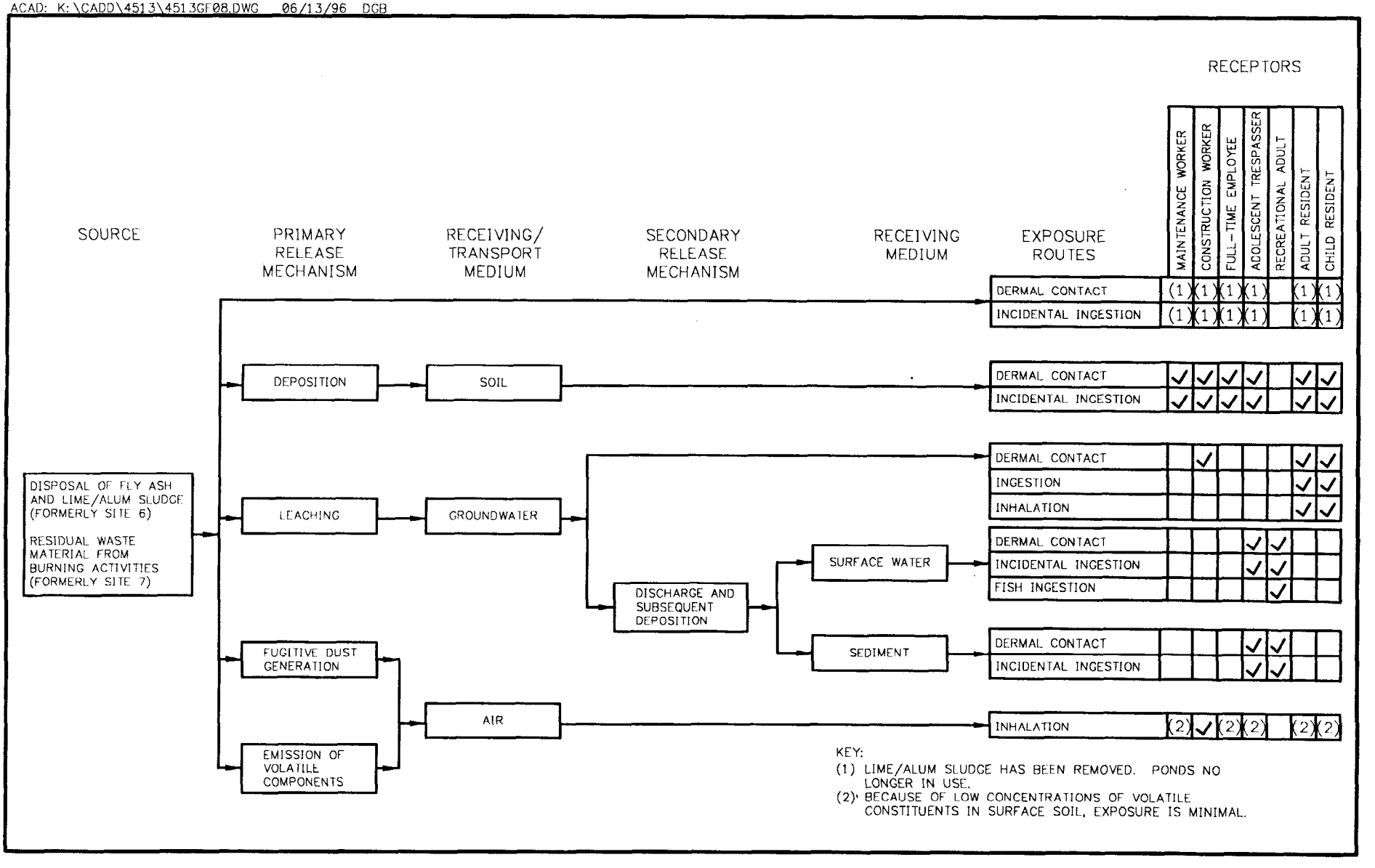
8.1 BASELINE HUMAN HEALTH RISK ASSESSMENT

The baseline risk assessment provides the basis for taking action and indicates the exposure pathways that need to be addressed by remedial action. It serves as the baseline indicating what risks could exist if no action were taken at OU3. This section of the ROD reports the results of the baseline risk assessment conducted for OU3.

A human health risk assessment was conducted for Operable Unit 3 using the most recent USEPA and USEPA Region IV guidance documents. The first step in the risk assessment was the selection of chemicals of potential concern (COPCs) for each medium sampled. A variety of chemicals were selected as COPCs, including metals, PAHs, dioxins/furans, benzene, and a few other volatile organic chemicals and pesticides. The selection consisted of comparing the maximum concentration of each compound detected to risk-based screening concentrations developed by USEPA Region III, and in the case of soil and groundwater, to background concentrations. The risk-based concentrations were calculated by the region to correspond to an individual chemical incremental lifetime cancer risk of 1E-6 (1×10^{-6}, or a one-in-one-million risk) and a Hazard Index of 0.1 for specified, routine exposure. Residential exposure levels were used for soil and sediment. Risk-based concentrations for residential use of groundwater were used for screening groundwater and surface water contaminants.

A conceptual site model, as shown in Figure 8-1, was developed in the exposure assessment. This model integrates the physical characteristics, exposed populations, sources of contamination, and contaminant mobility at OU3 to identify potential exposure routes and receptors.

Identified receptors under current land use conditions (vacant land with the eastern portion of Site 7 as a construction material storage area) included maintenance workers, trespassers, and recreational users of Slocum Creek. In addition, residents, full-time employees, and construction workers were also considered under future land use conditions (hypothetical industrial or residential land use scenarios). Maintenance workers and full-time employees were assumed to be exposed only to surface soil via direct contact during routine onsite activities. Trespassers were assumed to come into direct contact with surface soil, surface water, and surface water sediments. Recreational users were assumed to be exposed to surface water and sediment via direct contact. In addition, ingestion of fish was also considered. Under future land use conditions, construction workers represent potential receptors who could be exposed via direct contact to



CONCEPTUAL SITE MODEL
OPERABLE UNIT 3
MCAS CHERRY POINT, NORTH CAROLINA

FIGURE 8-1

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soils to a depth of perhaps 10 feet. Additional exposure routes considered for construction workers are direct contact with groundwater in the bottom of an excavation and inhalation of fugitive dust generated when the soil is disturbed. Future potential residents are assumed to be exposed to surface soil and groundwater via direct contact. The future residential exposure pathway for soil or groundwater Site 7 and groundwater at Site 6 is extremely unlikely because the anticipated land use of the eastern portion of Site 7 is strictly for storage of construction materials whereas the remaining portion of Site 7 is to remain vacant. In addition, the ingestion of groundwater from the surficial aquifer is unlikely to occur because this aquifer is not used as a water source and it is anticipated that it will never be used as a water source.

Two scenarios that were not considered to be applicable to OU3 are inhalation of volatile emissions or inhalation of fugitive dust under current land use conditions. Volatile emissions are considered to be minimal, as only low concentrations of volatile organic compounds were detected in the surface soil. Fugitive dust is not considered because the site is currently well vegetated.

Exposure concentrations are based on a statistical development of the upper 95 percent confidence level on the data set. There are many instances where, with isolated detections of high concentrations among many lower concentrations, the Upper Confidence Level (UCL) can exceed the maximum detected concentrations. In these cases, the maximum detection is used as the exposure concentration. Since this was the case for many chemicals of potential concern (COPCs) in most media at OU3, the risk assessment is considered to be extremely conservative.

Cancer Slope Factors (CSFs) have been developed by USEPAs Carcinogenic Assessment Group for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic COPCs. CSFs, which are expressed in units of $(mg/kg\text{-}day)^{-1}$, are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day, to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper bound" reflects the conservative estimate of risks calculated from the CSF. Use of this approach makes underestimations of the actual cancer risk highly unlikely. CSFs are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied (e.g., to account for the use of animal data to predict effects on humans).

For carcinogens, risks are estimated as the incremental probability of an individual's developing cancer over a lifetime as a result of exposure to the carcinogen. Excess lifetime cancer risk is calculated from the following equation:

$$Risk = CDI \times CSF$$

Where:

Risk = a unitless probability (e.g., $2E^{-6}$) of an individual developing cancer
CDI = chronic daily intake averaged over 70 years (mg/kg-day)
CSF = cancer slope factor, expressed as $(mg/kg\text{-}day)^{-1}$

These risks are probabilities that are generally expressed in scientific notation (e.g., 1E-6). An excess lifetime cancer risk of 1E-6 indicates that, as a reasonable maximum estimate, an individual has a one in one million chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year lifetime under the specific exposure conditions at a site.

Reference doses (RfDs) have been developed by USEPA for indicating the potential for adverse health effects from exposure to a COPC exhibiting noncarcinogenic effects. RfDs, which are expressed in units of mg/kg-day, are estimates of lifetime daily exposures for humans, including sensitive individuals. Estimated intakes of COPCs from environmental media (e.g., the amount of a COPC ingested from contaminated drinking water) can be compared to the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied (e.g., to account for the use of animal data to predict effects on humans).

The potential for noncarcinogenic effects is evaluated by comparing an exposure level over a specified time period (e.g., lifetime) with a reference dose derived for a similar exposure period. The ratio of exposure to toxicity is called a Hazard Quotient (HQ). By adding the HQs for all COPCs that affect the same target organ (e.g, liver) within a medium or across all media to which a given population may be reasonably exposed, the Hazard Index (HI) can be generated.

The HQ is calculated as follows:

$$\text{Non-cancer HQ} = CDI/RfD$$

Where:

CDI = chronic daily intake
RfD = reference dose

For carcinogens, an incremental lifetime cancer risk (ICR) of 1E-6 (a one-in-one-million risk) is generally considered the point at which the agency evaluates "unacceptable" risks, although the USEPA generally considers risks within the target range of 1E-6 to 1E-4 to be "acceptable." Risks greater than 1E-4, however,

are generally considered to be "unacceptable." For noncarcinogens, a Hazard Index (HI) of 1 is considered to represent the breaking point between "acceptable" and "unacceptable" toxic hazards. Target organ effects are considered when Hazard Indices exceed 1. Hazard Indices are not statistical values like cancer risks.

Cumulative risks for Site 6, summarized in Table 8-1, indicate that risks are within the target range except for the adult resident (6-year) (hazard index) and child resident (6-year) (hazard index and cancer risk). The majority of the risk to either recipient was due to ingestion of surficial aquifer groundwater and soil containing arsenic.

A 30-year residential exposure scenario was also evaluated for Site 6. This scenario is highly unlikely to occur as long as the property remains in military use. The incremental center risk (ICR) associated with exposure to soil for this receptor assume 6 years of exposure as a small child and an additional 24 years of exposure as an older child and adult. The ICR for the adult receptor at Site 6 under this scenario was 3.9E-4 which exceeds the USEPA target risk range. In addition the hazard index for both the child (7.6) and adult (1.8) exceeded 1.0.

Cumulative risks for Site 7, also summarized in Table 8-1, indicate that they were within the target range except for the construction worker (hazard index), adult resident (6-year) (hazard index and cancer risk), and child resident (6-year) (hazard index and cancer risk). The majority of the carcinogenic risks were due to the ingestion of groundwater containing arsenic, while the primary noncarcinogenic risks were due to future residents ingesting soil containing arsenic and groundwater containing benzene and arsenic.

A 30-year residential exposure scenario was also evaluated for Site 7. The ICR for the adult receptor at Site 7 under this scenario was 8.0E-4, which exceeds the USEPA target risk range. The hazard index for both the child (33.8) and adult (9.5) exceeded 1.0.

Table 8-1 indicates that cumulative risks to both trespassers and recreational users due to exposure to surface waters and sediments were within the USEPA range of "acceptable" risks.

Although Table 8-1 indicates that these would be the only receptors that would be exposed to "unacceptable risks," lead is present in the soil at Site 7 at levels above recommended screening levels (both residential and industrial).

8.2 ECOLOGICAL RISK ASSESSMENT

As part of the ecological assessment performed at this site, areas of wetlands were delineated. A Carex sp. marsh was identified in a low area of Site 7. Wet pine flatwoods were located north of Luke Rowe's Gut

TABLE 8-1

SUMMARY OF CUMULATIVE RISKS
OPERABLE UNIT 3
MCAS CHERRY POINT, NORTH CAROLINA

Receptor	Exposure Pathway	Site 6		Site 7	
		Cancer Risk	Hazard Index	Cancer Risk	Hazard Index
Maintenance Worker	Direct contact with surface soil.	3.7E-06	0.032	2.7E-6	0.12
Construction Worker	Direct contact with soil and groundwater; inhalation of fugitive dust.	4.4E-6	0.57	4.5E-6	7.1*(1)
Adolescent Trespasser	Direct contact with surface soil.	9.9E-7	0.015	7.7E-7	0.068
	Direct contact with Slocum Creek water and sediment(2).	2.3E-7	0.0061		
	Direct contact with Luke Rowe's Gut water and sediment(2).	1.8E-7	0.0046		
Adult Recreational User	Direct contact with Slocum Creek water and sediment; ingestion of fish(2).	1.9E-6	0.034		
Full-Time Employee	Direct contact with surface soil.	2.8E-5	0.19	2.1E-5	0.80
Adult Resident (6 year)	Direct contact with groundwater and surface soil.	4.9E-5	1.8*	1.2E-4*	9.5*
Child/Adult Resident (30 year)	Direct contact with groundwater and surface soil.	3.9E-4*	7.6(child)* 1.8(adult)*	8.0E-4*	33.8(child)* 9.5(adult)*
Child Resident (6 year)	Direct contact with groundwater and surface soil.	2.0E-4*	7.6*	3.3E-4*	33.8*

1 An asterisk indicates an "unacceptable" risk.
2 This exposure pathway was evaluated only once.

adjacent to Slocum Creek. Coastal plain small stream swamp areas were identified on both sides of Luke Rowe's Gut, and a small area of tidal freshwater marsh was located on both sides of the mouth of Luke Rowe's Gut.

An ecological conceptual site model is presented (Figure 8-2) detailing sources, release mechanisms, transport media, exposure mechanisms, exposure routes, and receptors. An ecological assessment was performed using recent surface water and sediment data in both Slocum Creek and Luke Rowe's Gut, and soil data. Groundwater sampling data were used qualitatively. HQs greater than 1 indicate the potential for adverse ecological effects in sensitive species.

The results of the ecological assessment indicate that some contaminants are present in OU3 surface water, sediment, and surface soil in concentrations that exceed screening benchmarks. However, risks implied by most of these exceedances are mitigated by several factors.

In Luke Rowe's Gut only a few COPCs were identified in the surface water samples. No COPCs were identified in the sediment samples, although several compounds were detected at concentrations above the preliminary levels protective of the environment. However, they were not considered to be COPCs because the detections of these compounds appear to be isolated occurrences. Since few, if any, compounds were identified as COPCs, widespread contamination and significant potential risks are considered to be absent in Luke Rowe's Gut. Some COPCs were identified in Slocum Creek surface water and sediment samples, but for the most part, these compounds are not believed to be related to OU3, as evidenced by the presence of elevated concentrations in the upgradient samples. Therefore, Slocum Creek has been designated as a separate Operable Unit and will be evaluated further.

In surface soils, potential risks were assessed using two approaches. To begin with, maximum contaminant concentrations in surface soils were compared to conservative screening levels that were mainly based on human health risks. To reduce uncertainties and generate a risk range, mean contaminant concentrations were then compared to more realistic but generally less conservative ecologically-based benchmarks. Most of the COPCs from the conservative first screening were not retained as COPCs using the mean concentrations and ecologically-based benchmarks, although a few metals still had slightly elevated HQ values. However, most of the elevated detections of those metals were located in a relatively small portion of OU3, and the habitat in that area is marginal.

For the second approach, terrestrial foodchain modeling using representative terrestrial receptors was performed to investigate potential ecological risks from surface soil contaminants. Using the maximum contaminant concentrations and several conservative assumptions, HI values for all receptors were high. To reduce uncertainties and generate a risk range, mean contaminant concentrations were then used. HI

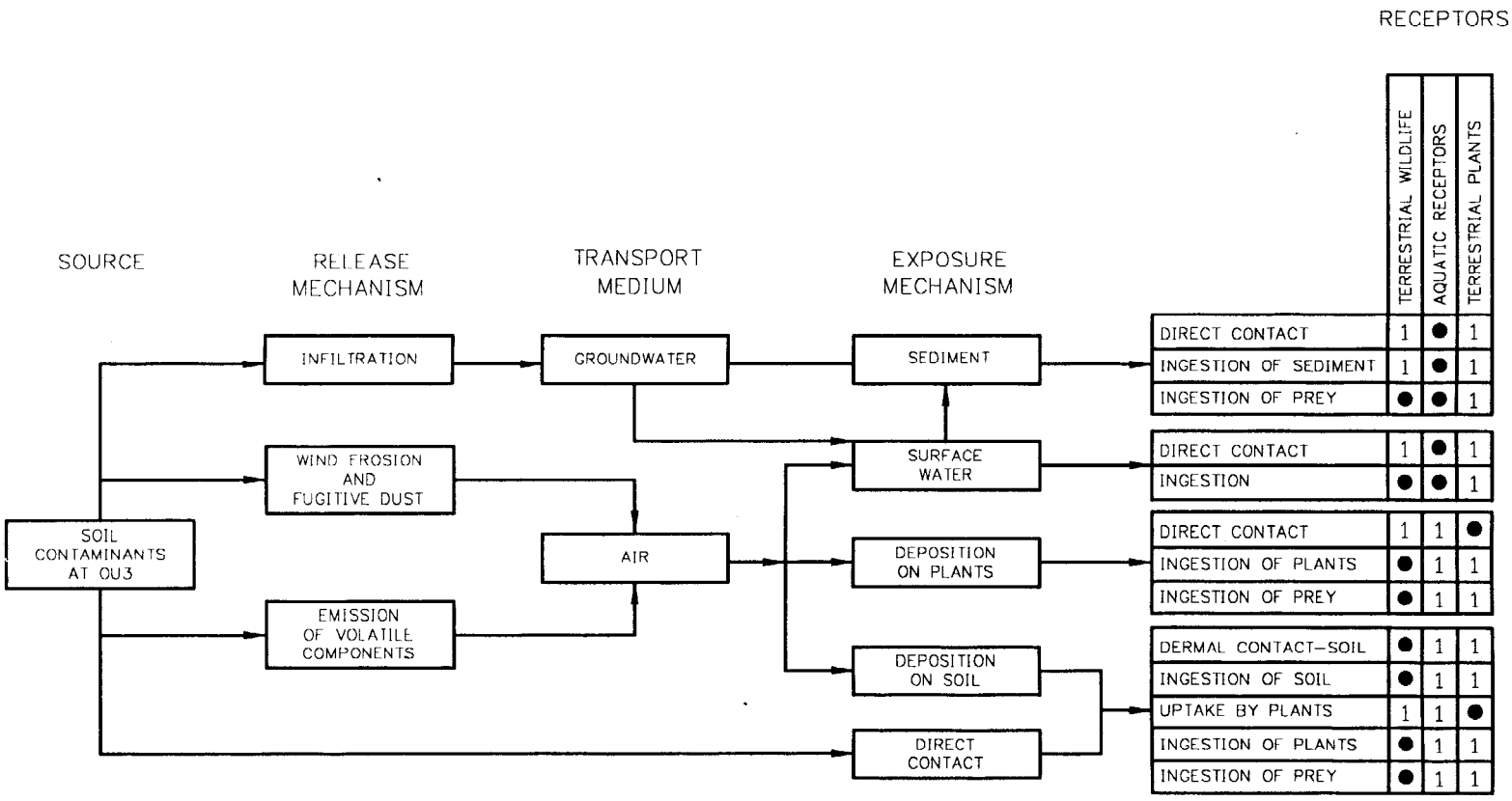

FIGURE 8-2

ECOLOGICAL CONCEPTUAL SITE MODEL
OPERABLE UNIT 3
MCAS CHERRY POINT, NORTH CAROLINA

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values were reduced by approximately one-half for all contaminants for all receptors, but were still relatively high. However, the majority of the remaining HI values were a result of the conservative assumptions in the models. In addition, the COPCs from the foodchain models were primarily metals, and potential risks from these contaminants were heavily mitigated by the factors discussed above.

For these reasons, potential risks to ecological receptors from OU3-related contaminants do not appear to be significant. As a result, additional study or remediation based on ecological concerns at OU3 is not warranted.

9.0 DESCRIPTION OF ALTERNATIVES

Various technologies and process options were screened and evaluated under the FS for OU3. Ultimately, seven Remedial Action Alternatives were developed, as listed below:

- Alternative 1 - No Action at Site 6 and Site 7.
- Alternative 2 - Institutional Controls at Site 6 and Site 7.
- Alternative 3 - In-Situ Fixation/Solidification of Surface Soils at Site 7, and Institutional Controls at Site 6 and Site 7.
- Alternative 4 - Excavation, and Offsite Disposal of Surface Soils at Site 7, and Institutional Controls at Site 6 and Site 7.
- Alternative 5 - Excavation, Onsite Ex-Situ Fixation/Solidification, and Reuse as Fill of Surface Soils at Site 7, and Institutional Controls at Site 6 and Site 7.
- Alternative 6 - Soil Cover at Site 7 and Institutional Controls at Site 6 and Site 7.
- Alternative 7 - Partial Dewatering at Site 7, Excavation and Offsite Disposal of Surface/Subsurface soils at Site 7, and Institutional Controls at Site 6 and Site 7.

A concise description of remedial action alternatives evaluated during the FS for contamination contained in the OU3 surface soils is presented in this section. Groundwater control and treatment procedures are only included in those treatment alternatives which propose some impact on the contaminated shallow aquifer underlying OU3 (Alternative 7).

9.1 ALTERNATIVE 1 - NO ACTION AT SITE 6 AND SITE 7

This alternative is required under CERCLA to establish a baseline for comparison. Under this alternative, no further actions will be taken and the site will be left status quo.

9.2 ALTERNATIVE 2 - INSTITUTIONAL CONTROLS AT SITE 6 AND SITE 7

Institutional controls at Sites 6 and 7 would consist of the following:

- maintaining records of the contamination at OU3 in the MCAS Cherry Point Base Master Plan.
- restricting land use at OU3 to non-residential uses for Site 6, to non-residential uses with the provision for no intrusive activities (no excavation of surface soils (0-1 foot) or subsurface soil (>1 foot)) for the eastern portion of Site 7, and to vacant land for the western portion of Site 7.
- restricting the use of groundwater beneath OU3.
- fencing the western portion of Site 7.
- placing warning signs along the fence and Slocum Creek and Luke Rowe's Gut within the western portion of Site 7.
- monitoring of groundwater under OU3, and surface waters and sediments in Slocum Creek and Luke Rowe's Gut, as per State and Federal requirements.
- complying with OSHA regulations during (future) construction at Site 6 and the eastern portion of Site 7, and the construction of the fence along the western portion of Site 7.

The records on the presence of contamination at OU3 and the specific restrictions for site use listed above (including land use and groundwater use restrictions) would be recorded in the Air Station's Base Master Plan and would ensure that, at the time of future land development, MCAS Cherry Point would be able to take adequate measures to minimize adverse human health and environmental effects.

The fencing and warning signs would be installed to restrict access to the western portion of Site 7 and, therefore, minimize human exposure to contaminated media (soil with lead at concentrations above 1,300 mg/kg) (approximately 150,000 square feet). Monitoring would consist of the sampling of groundwater at Sites 6 and 7 and surface waters and sediments in Slocum Creek and Luke Rowe's Gut to assess the migration of contaminants from OU3 into the environment.

Any future construction activity at Site 6 and the eastern portion of Site 7, along with the construction of the fence around the western portion of Site 7 must be conducted in compliance with OSHA requirements, a

condition which would minimize the potential for contaminants to enter the exposure pathways (mainly incidental ingestion) for construction workers on site. The OSHA requirements are especially important for construction of the fence at Site 7 because of the presence of significant surface soil contamination at levels that are expected to pose a threat to worker health.

Every 5 years a site review would be conducted to evaluate the site status and provide direction for further action, if deemed necessary at that time. The site review is required because this alternative allows contaminants to remain at levels that exceed RGOs. If the property is sold for private use, a deed restriction must be placed on the site to ensure the continuation of institutional controls and monitoring.

9.3 ALTERNATIVE 3 - IN-SITU FIXATION/SOLIDIFICATION OF SURFACE SOILS AT SITE 7 AND INSTITUTIONAL CONTROLS AT SITE 6 AND SITE 7

The area delineated in the FS as exceeding RGOs for a residential land use scenario would be addressed in this alternative. Waste/fill and metals contaminated surface soils over an area of approximately 241,000 square feet and 2 feet deep (approximately 18,000 cubic yards) at Site 7 would be mixed in-place with water and fixating/solidifying agents such as lime or portland cement. After approximately 10 days of curing, the hardened, soil/lime or soil/cement mixture would be covered with a layer of topsoil and then seeded. Because of potential volume increases in the mixed soil, a rip-rap layer may be used for slope stability.

The soil solidification process will minimize the mobility of the metals within the soil matrix and the leachability of the metals from the soil into the groundwater or surface water. The soil cap would eliminate direct exposure pathways between the metal contaminants in the surface soil, especially lead, and human or ecological receptors. With the direct exposure pathways eliminated, future use of the land at Site 7 could include residential and industrial uses. Site 6 would still be restricted to non-residential uses.

This alternative would also include all of the institutional controls detailed in Alternative 2 with the exception that the fence and warning signs would not be required for the western portion of Site 7. In addition, the land use restrictions at Site 7 would be limited to prohibiting intrusive activities (no excavation of surface or subsurface soils) at the entire site.

The five year site review outlined in Alternative 2 would be required for this alternative because this alternative still allows contaminants to remain on the site at levels that exceed RGOs.

9.4 ALTERNATIVE 4 - EXCAVATION AND OFFSITE DISPOSAL OF SURFACE SOILS AT SITE 7 AND INSTITUTIONAL CONTROLS AT SITE 6 AND SITE 7

Under Alternative 4, approximately 18,000 cubic yards of waste/fill materials and metals contaminated surface soils at Site 7 (the same area that was outlined in Alternative 3) would be excavated and would be disposed of off site at a nonhazardous waste landfill. Approximately 18,000 cubic yards of clean fill would be placed and compacted in the excavated area. A 1-foot topsoil layer would be placed on top of the compacted fill, and the topsoil would be seeded.

Exposure of human and ecological receptors to waste/fill materials and to metals contamination in the surface soil at Site 7 would be eliminated by offsite disposal of the excavated surface materials.

This alternative would also include all of the institutional controls detailed in Alternative 2 with the exception that the fencing and warning signs would not be required. Land use restrictions at Site 7 would be limited to prohibiting intrusive activities (no excavation of surface or subsurface soils) at the entire site. The five year site review outlined in Alternative 2 would be required for this alternative because this alternative still allows contaminants to remain in the groundwater at levels that exceed RGOs.

9.5 ALTERNATIVE 5 - EXCAVATION, ONSITE EX-SITU FIXATION/SOLIDIFICATION AND REUSE AS FILL OF SURFACE SOILS AT SITE 7, AND INSTITUTIONAL CONTROLS AT SITE 6 AND SITE 7

Under Alternative 5, approximately 18,000 cubic yards of waste/fill and metals-contaminated surface soil (the same area that was outlined in Alternatives 3 and 4) would be excavated from Site 7 and mixed with water and fixating/solidifying agents such as lime or portland cement. The soil/solidifying agent mixture would be backfilled into the excavated area and allowed to cure. After approximately 10 days of curing, the hardened, soil/lime or soil/cement mixture would be compacted and covered with a 1 foot layer of topsoil and seeded. Because of potential volume increases in the mixed soil, a rip-rap layer may be used for slope stability.

As with Alternative 3, the soil solidification process will minimize the mobility of the metals within the soil matrix and the leachability of the metals from the soil into the groundwater or surface water. The soil cap would eliminate direct exposure pathways between the metal contaminants in the surface soil, especially lead, and human or ecological receptors. With the direct exposure pathways eliminated, future use of the land at Site 7 could include residential and industrial uses. Site 6 would still be restricted to non-residential uses.

This alternative would also include all of the institutional controls detailed in Alternative 2 with the exception that the fence and warning signs would not be required for the western portion of Site 7. In addition, the land use restrictions at Site 7 would be limited to prohibiting intrusive activities (no excavation of surface or subsurface soils) at the entire site.

The five year site review outlined in Alternative 2 would be required for this alternative because this alternative still allows contaminants to remain on the site at levels that exceed RGOs.

9.6 ALTERNATIVE 6 - SOIL COVER AT SITE 7 AND INSTITUTIONAL CONTROLS AT SITE 6 AND SITE 7

Under Alternative 6, approximately 241,000 square feet of waste/fill and metals-contaminated surface soil at Site 7 (the same area that was outlined in the previous alternatives) would be covered with a 2-foot layer of clean fill, which would be compacted. A 1-foot layer of top soil would be placed on top of the compacted fill and seeded.

The soil cap would eliminate direct exposure pathways between the metal contaminants in the surface soil, especially lead, and human or ecological receptors. With the direct exposure pathways eliminated, future use of the land at Site 7 could include residential and industrial uses. Site 6 would still be restricted to non-residential uses.

This alternative would also include all of the institutional controls detailed in Alternative 2 with the exception that the fence and warning signs would not be required for the western portion of Site 7. In addition, the land use restrictions at Site 7 would be limited to prohibiting intrusive activities (no excavation of surface or subsurface soils) at the entire site.

The five year site review outlined in Alternative 2 would be required for this alternative because this alternative still allows contaminants to remain on the site at levels that exceed RGOs.

9.7 ALTERNATIVE 7 - PARTIAL DEWATERING AT SITE 7, EXCAVATION AND OFFSITE DISPOSAL OF SURFACE/SUBSURFACE SOILS AT SITE 7, AND INSTITUTIONAL CONTROLS AT SITE 6 AND SITE 7

Waste/fill and metals contaminated soils over an area approximately 241,000 square feet and 5 feet deep (approximately 45,000 cubic yards) would be excavated to eliminate the sources of groundwater contamination. The excavated waste/fill and contaminated soil would be disposed of off site at a

nonhazardous waste landfill. Approximately 45,000 cubic yards of clean fill would be placed, compacted, and seeded in the excavated area.

In order to excavate the soil to a depth of 5 feet, the groundwater table will need to be lowered below that level. A 2,200-foot-long slurry wall extending approximately 30 feet to the confining layer would be constructed around the boundary of Site 7. The groundwater within the slurry wall would then be pumped at a rate (approximately 50 gallons per minute) sufficient to lower the water table below the bottom of the excavation. Since the groundwater being removed would be contaminated with metals and volatile organic compounds, the groundwater would be treated at the Air Station's Industrial Wastewater Treatment Plant prior to discharge. The treatment would include equalization, precipitation, flocculation/clarification, pressure filtration, and activated carbon polishing.

Because this alternative does not address the contamination at Site 6 or the entire volume of contaminated groundwater at Site 7, this alternative would also include all of the institutional controls detailed in Alternative 2 with the exception that the fencing and warning signs at Site 7 would not be required. Land use restrictions at Site 7 would be limited to prohibiting intrusive activities (no excavation of surface or subsurface soils) at the entire site. The five year site review outlined in Alternative 2 would be required for this alternative because this alternative still allows contaminants to remain in the groundwater at levels that exceed RGOs.

10.0 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

A detailed analysis was performed during the FS on the seven alternatives using the nine evaluation criteria in order to select a preferred remedial alternative. Table 10-1 presents a summary of this detailed analysis. A glossary of the evaluation criteria, as discussed below is provided in Table 10-2.

10.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The main concern addressed is the protection of human health because of soil contaminants. The use of institutional controls and the provision of a safe water supply to future residents on site would address the concern resulting from groundwater contaminants. Monitoring would indicate the need for any additional remedial activity for the future protection of the environment.

Alternative 1 would not be protective of human health and the environment for Site 7. All of the other alternatives would provide some protection of human health and the environment.

10.2 COMPLIANCE WITH ARARS AND TBCS

The three main Applicable or Relevant and Appropriate Requirements (ARARs) and To-Be-Considered criteria (TBCs) used for the comparison are: (1) Human Health Soil Standards based on Risk-Based Concentration (RBCs) and the USEPA draft Soil Screening Levels (SSLs), which are TBCs; (2) Soil cover requirements for sanitary waste landfills that are potentially relevant and appropriate; and (3) North Carolina Groundwater Quality Standards (NCGWQ).

Alternative 1 would not comply with the soil cover relevant and appropriate requirement, the soil TBCs, or the groundwater quality standards. Alternative 2 would not comply with the soil cover relevant and appropriate requirement or the groundwater quality standards but could potentially comply with the soil TBCs. All of the other alternatives (3 through 7) could potentially comply with the soil cover relevant and appropriate requirement and the soil TBCs. None of the other alternatives comply with the groundwater quality standards.

TABLE 10-1

SUMMARY OF EVALUATION OF ALTERNATIVES
RECORD OF DECISION, CTO 190
OPERABLE UNIT 3, MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

Evaluation Criteria	Alternative 1: No Action at Site 6 and Site 7	Alternative 2: Institutional Controls at Sites 6 and 7	Alternative 3: In-situ Fixation/Solidification of Surface Soils at Site 7; Institutional Controls at Sites 6 and 7	Alternative 4: Excavation and Offsite Disposal of Surface Soils at Site 7; Institutional Controls at Sites 6 and 7
Threshold Criteria				
Overall Protection of Human Health and Environment	No reduction in potential risks except through natural attenuation of the groundwater.	Institutional controls and monitoring will reduce potential risks to human health and the environment under current and proposed exposure scenarios.	Institutional controls and monitoring provide some protection of human health and the environment. Fixation/solidification reduces potential exposure for humans and provides some protection for the environment.	Institutional controls and monitoring provide some protection of human health and the environment. Excavation removes source of potential health hazards.
Compliance with ARARs				
Chemical-Specific ARARs	No active effort to reduce contaminant levels to below federal or state ARARs.	Can potentially comply with human health standards for soil. Does not comply with NCGWQ standards.	Can potentially comply with human health standards for soil. Does not comply with NCGWQ standards.	Can potentially comply with human health standards for soil. Does not comply with NCGWQ standards.
Location-Specific ARARs	Not applicable.	Not applicable.	Can be designed to attain ARARs that apply.	Can be designed to attain ARARs that apply.
Action-Specific ARARs	Not applicable.	Not applicable.	Can be designed to attain ARARs that apply.	Can be designed to attain ARARs that apply.
Primary Balancing Criteria				
Long-term Effectiveness and Permanence	Allows risk to remain uncontrolled.	Protection of potential land users is questionable; success depends on administration of MCAS Master Plan.	Long-term effectiveness is questionable since in-situ solidification is a new remediation technique. This alternative should reduce risks to future land users.	Removal of contaminant source will reduce site hazards to potential land users. Institutional controls will further limit risks. Effectiveness is dependant on maintenance of the soil cover over the contaminated subsurface. Some liability concerns associated with offsite disposal facility.

TABLE 10-1 (Continued)
SUMMARY OF EVALUATION OF ALTERNATIVES
RECORD OF DECISION, CTO 190
OPERABLE UNIT 3, MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

Evaluation Criteria	Alternative 1: No Action at Site 6 and Site 7	Alternative 2: Institutional Controls at Sites 6 and 7	Alternative 3: In-situ Fixation/Solidification of Surface Soils at Site 7; Institutional Controls at Sites 6 and 7	Alternative 4: Excavation and Offsite Disposal of Surface Soils at Site 7; Institutional Controls at Sites 6 and 7
Reduction of Toxicity, Mobility, or Volume through Treatment	No treatment other than natural attenuation of the groundwater.	No treatment, other than natural attenuation of the groundwater.	The mobility of contaminants would be reduced. The toxicity and volume of contaminants would be unaffected. No treatment of groundwater, other than natural attenuation.	The volume of contaminated surface soils at Site 7 would be reduced. Subsurface contamination toxicity, mobility, and volume would be unaffected. No treatment for groundwater other than through natural attenuation.
Short-term Effectiveness	Not applicable, no short-term impacts/concerns at site.	Proper system management will limit short term hazards associated with institutional controls. Less than one year to implement.	Proper system management will limit short term hazards associated with contaminated media treatment. Less than one year to implement.	Proper system management will limit short term hazards associated with contaminated media treatment. Less than one year to implement.
Implementability	Nothing to implement. No monitoring to show effectiveness.	Enforcement of institutional controls at military site is proven to be effective and reliable. Monitoring will demonstrate effectiveness.	Enforcement of institutional controls at military site is proven to be effective and reliable. Treatability studies will be necessary to confirm adequate fixation/solidification can be achieved. Monitoring will demonstrate effectiveness.	Enforcement of institutional controls at military site is proven to be effective and reliable. Surface soil will need tested for acceptance at offsite disposal facility. Alternative consists of common remediation practices, which are readily available/implementable. Monitoring will demonstrate effectiveness.
Costs: Capital O&M NPW	 $0 $0 $0	 $27,000 $22,000 ($62,000 every fifth year due to site review) $470,000	 $2,340,000 $22,000 ($62,000 every fifth year due to site review) $2,800,000	 $6,800,000 $22,000 ($62,000 every fifth year due to site review) $7,300,000
Modifying Criteria				
U.S. EPA/State Acceptance	Not acceptable to U.S. EPA and NCDEHNR.	Not completely acceptable to NCDEHNR.	Not completely acceptable to NCDEHNR.	Not completely acceptable to NCDEHNR.

TABLE 10-1 (Continued)
SUMMARY OF EVALUATION OF ALTERNATIVES
RECORD OF DECISION, CTO 190
OPERABLE UNIT 3, MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

Evaluation Criteria	Alternative 5: Excavation Onsite Ex-Situ Fixation/Solidification and Reuse as Fill of Surface Soils at Site 7; Institutional Controls at Sites 6 and 7	Alternative 6: Soil Cover at Site 7; Institutional Controls at Sites 6 and 7	Alternative 7: Partial Dewatering at Site 7, Excavation and Offsite Disposal of Surface/Subsurface Soils, at Site 7; Institutional Controls at Sites 6 and 7
Threshold Criteria			
Overall Protection of Human Health and Environment	Institutional controls and monitoring provide some protection to human health and the environment. Fixation/solidification reduces potential exposure for humans and provides some protection for the environment. No treatment of groundwater other than through natural attenuation.	Institutional controls and monitoring provide some protection to human health and the environment. Future land users would be protected from exposure to the contamination by the soil cover. The cover would also add a level of protection to the environment by reducing contaminant migration. No treatment of groundwater other than through natural attenuation.	Institutional controls and monitoring provide some protection of human health and the environment. Excavation removes source of potential health hazards.
Compliance with ARARs			
Chemical-Specific ARARs	Can potentially comply with human health standards for soils. Does not comply with NCGWQ standards.	Can potentially comply with human health standards for soils. Does not comply with NCGWQ standards.	Can potentially comply with human health standards for soils. Does not comply with NCGWQ standards.
Location-Specific ARARs	Can be designed to attain ARARs that apply.	Can be designed to attain ARARs that apply.	Can be designed to attain ARARs that apply.
Action-Specific ARARs	Can be designed to attain ARARs that apply.	Can be designed to attain ARARs that apply.	Can be designed to attain ARARs that apply.
Primary Balancing Criteria			
Long-term Effectiveness and Permanence	Long-term effectiveness is not a concern since the solids and matrix would be similar to pozzolonic composites. This alternative should reduce risks to future land users.	Soil cover will reduce risk to potential land users provided the soil cover is maintained. Institutional controls are necessary to maintain protection in the long term.	Removal of contaminated surface and subsurface soil will reduce site hazards to potential land users. Institutional controls will further limit risks. Some liability concerns associated with offsite disposal facility.

TABLE 10-1 (Continued)
SUMMARY OF EVALUATION OF ALTERNATIVES
RECORD OF DECISION, CTO 190
OPERABLE UNIT 3, MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

Evaluation Criteria	Alternative 5: Excavation Onsite Ex-Situ Fixation/Solidification and Reuse as Fill of Surface Soils at Site 7; Institutional Controls at Sites 6 and 7	Alternative 6: Soil Cover at Site 7; Institutional Controls at Sites 6 and 7	Alternative 7: Partial Dewatering at Site 7, Excavation and Offsite Disposal of Surface/Subsurface Soils, at Site 7; Institutional Controls at Sites 6 and 7
Reduction of Toxicity, Mobility, or Volume through Treatment	The mobility of contaminants would be reduced. The toxicity and volume of contaminants would be unaffected. No treatment of the groundwater other than through natural attenuation.	The toxicity, mobility, and volume of contaminants would remain unaffected. No treatment of the groundwater other than through natural attenuation. Natural attenuation through dilution/dispersion would be reduced.	The volume of contaminated surface and subsurface soils and groundwater at Site 7 would be reduced. The toxicity and mobility would be unaffected.
Short-term Effectiveness	Proper system management will limit short term hazards associated with contaminated media treatment and potential exposure to workers during alternative implementation. Less than one year to implement.	Proper system management will limit short term hazards associated with contaminated media treatment and potential exposure to workers during alternative implementation. Less than one year to implement.	Proper system management will limit short term hazards associated with contaminated media treatment. One year to implement.
Implementability	Enforcement of institutional controls at military site is proven to be effective and reliable. Treatability studies will be necessary to confirm adequate fixation/solidification can be achieved. Monitoring will demonstrate effectiveness.	Enforcement of institutional controls at military site is proven to be effective and reliable. Alternative consists of common remediation practices, which are readily available/implementable. Monitoring will demonstrate effectiveness.	Enforcement of institutional controls at military site is proven to be effective and reliable. Soil will need tested for acceptance at offsite disposal facility. Alternative consists of common remediation practices, which are readily available/implementable. Monitoring will demonstrate effectiveness.
Costs Capital O&M NPW	 $3,800,000 $22,000 ($62,000 every fifth year due to site review) $4,300,000	 $2,200,000 $22,000 ($62,000 every fifth year due to site review) $2,600,000	 $16,500,000 $22,000 ($62,000 every fifth year due to site review) $16,500,000
Modifying Criteria			
U.S. EPA/State Acceptance	Not completely acceptable to NCDEHNR.	Not completely acceptable to NCDEHNR.	Acceptable to NCDEHNR.

TABLE 10-2

GLOSSARY OF EVALUATION CRITERIA

- **Overall Protection of Human Health and Environment** - Addresses whether or not an alternative provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

- **Compliance with ARARs** - Addresses whether or not an alternative will meet all of the applicable or relevant and appropriate requirements (ARARs), other criteria to be considered (TBCs), or other Federal and state environmental statutes and/or provide grounds for invoking a waiver.

- **Long-term Effectiveness and Permanence** - Refers to the magnitude of residual risk and the ability of an alternative to maintain reliable protection of human health and the environment over time once cleanup goals have been met.

- **Reduction of Toxicity, Mobility, or Volume through Treatment** - Addresses the anticipated performance of the treatment options that may be employed in an alternative.

- **Short-term Effectiveness** - Refers to the speed with which the alternative achieves protection, as well as the remedy's potential to create adverse impacts on human health and the environment that may result during the construction and implementation period.

- **Implementability** - Addresses the technical and administrative feasibility of an alternative, including the availability of materials and services needed to implement the chosen solution.

- **Cost** - Includes capital and operation and maintenance costs. For comparative purposes, provides present-worth values.

- **USEPA/State Acceptance** - Evaluates the technical and administrative issues and concerns that the USEPA and the State of North Carolina have regarding each of the alternatives. This criterion is addressed in the ROD once comments on the RI/FS report and the Proposed Plan have been received.

- **Community Acceptance** - Evaluates the issues and concerns the public may have regarding each of the alternatives. This criterion is addressed in the ROD once comments on the RI/FS report and Proposed Plan have been received.

10.3 LONG-TERM EFFECTIVENESS AND PERMANENCE

The main concerns in this category are the reliability of institutional controls on the residual soil and groundwater contaminants at the site and the reliability of controls at offsite disposal facilities.

Alternative 1 is not effective in the long term. Alternative 2 is entirely dependent on the administration of the Air Station for its effectiveness. Alternatives 3, 4, 5, 6, and 7 are partially dependent on the administration of the Air Station, among which Alternatives 3 and 5 are the least dependent because of the potential long-term integrity of the treated material. Alternative 6 is somewhat more dependent on institutional controls than Alternatives 3 and 5 because the integrity of the soil cover can be more easily compromised in Alternative 6 than that of the solidified material in Alternatives 3 and 5. Alternatives 4 and 7 are also dependent on the reliability of controls at the offsite nonhazardous waste landfill.

10.4 REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT

The three concerns for this criterion are reduction in toxicity, reduction in mobility, or reduction in volume. Alternative 7 achieves some reduction in volume of contaminated groundwater through treatment. None of the other alternatives would achieve any reduction of contaminant toxicity or volume through treatment other than through potential natural attenuation. Natural attenuation would be significantly retarded for Alternatives 3 and 5. Alternatives 4 and 7 achieve reduction of the volume of contaminated soil at Site 7 by moving it to an offsite disposal facility.

Alternatives 1, 2, 4, 6 and 7 do not achieve any reduction in mobility through treatment. Only Alternatives 3 and 5 provide for a reduction in mobility through treatment but result in a total increase in volume.

10.5 SHORT-TERM EFFECTIVENESS

The main concerns relate to potential effects to the workers and community during remedial action. This is not relevant to Alternative 1, wherein no remedial activities are involved.

Alternatives 2 and 6 have minimal concerns. Alternative 3 presents a minor potential for worker exposure to in-situ contaminants. Alternative 4 presents a minor potential for community or worker exposure to a relatively small volume of contaminated material. Alternative 7 presents a greater potential for community or worker exposure to a larger volume of contaminated material. Alternative 5 presents a greater potential for worker exposure to contaminants because of excavation and processing.

Although the comparison of alternatives may indicate that certain alternatives pose more short-term effectiveness concerns than others, potentially all alternatives can be implemented with minimal effects on workers and the community.

10.6 IMPLEMENTABILITY

The main concerns in this category relate to the ease of implementation, including availability of equipment, treatment, storage, and disposal facilities and the technical complexity of the processes, etc. This criterion is not applicable to Alternative 1. All of the other alternatives are implementable; furthermore, only the alternatives involving in-situ or ex-situ onsite treatment technologies (such as Alternatives 3 and 5) may require treatability studies.

It must be noted that although the comparison indicates that certain alternatives have more implementability concerns than others, all alternatives are implementable.

10.7 COST

In terms of net present worth (NPW), the No Action alternative (Alternative 1) would be the least expensive to implement, followed by Alternatives 2, 6, 3, 5, 4 and 7. The estimated NPW values in increasing order are $0 (Alternative 1), $470,000 (Alternative 2), $2.6 million (Alternative 6), $2.8 million (Alternative 3), $4.3 million (Alternative 5), $7.3 million (Alternative 4), and $16.5 million (Alternative 7).

10.8 USEPA/STATE ACCEPTANCE

NCDEHNR and USEPA accepted Alternative 2 with the modifications outlined in Sections 11 and 13.

10.9 COMMUNITY ACCEPTANCE

The community accepted Alternative 2 with the modifications outlined in Sections 11 and 13.

11.0 SELECTED REMEDY

11.1 REMEDY SELECTION

Based on consideration of the requirements of CERCLA, the detailed analysis of potential alternatives using the evaluation criteria, and current and proposed exposure scenarios, the preferred remedial alternative for OU3 is Alternative 2 -Institutional controls at Site 6 and Site 7 with the modifications noted here and outlined in Section 13. This alternative, with the modifications noted here and described in Section 13, appears to provide the best balance with respect to the seven CERCLA evaluation criteria described in previous sections of this report. The preferred alternative is cost effective and is anticipated to meet the following objectives:

- Prevent potential exposure to waste/fill material and contaminated soil.
- Restrict current and future land use at OU3.
- Prevent exposure to contaminated groundwater at OU3.
- Prevent future potential use of the groundwater at OU3.
- Allow for natural attenuation of the groundwater at OU3.
- Provide for removal, treatment, or control of secondary sources of groundwater contamination (contaminated soil) (see Section 13).

Based on current potential exposure scenarios and future exposure scenarios, all risks are within the EPAs "acceptable" risk range except for the future hypothetical residential exposure (Sites 6 and 7) and future hypothetical construction worker (Site 7). The majority of the risks are due to ingestion of groundwater and ingestion of surface soil. In addition, lead is present in the soil at concentrations above recommended screening levels. The future residential exposure pathway for groundwater is extremely unlikely because the surficial aquifer is not used as a source of drinking water, and the Air Station has a separate potable water supply system.

Under the preferred alternative, the following institutional controls would be implemented to eliminate or reduce pathways of exposure:

- maintaining records of the contamination at OU3 in the MCAS Cherry Point Base Master Plan.

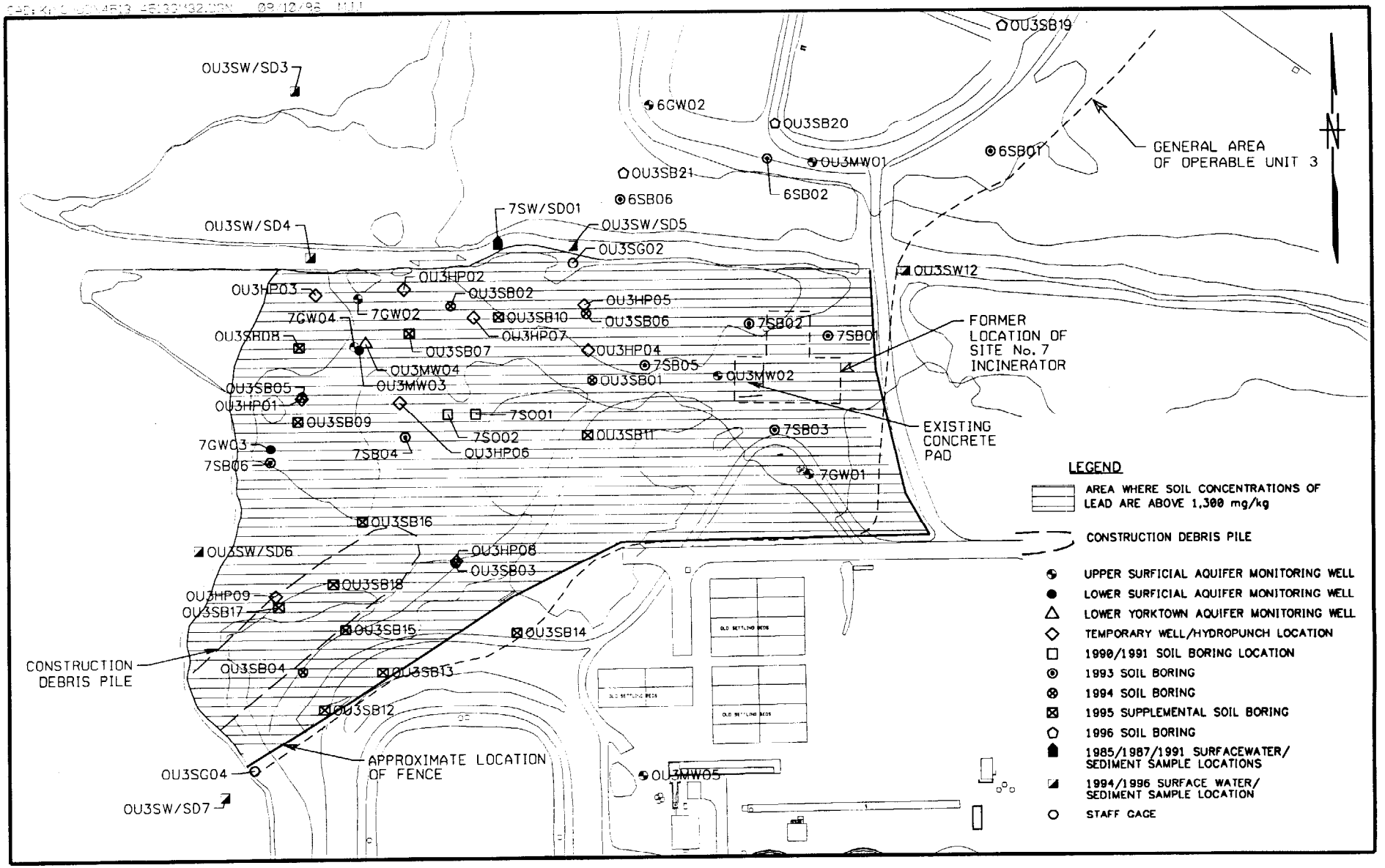
- restricting land use at OU3 to non-residential uses for Site 6, and to vacant land for Site 7.

- restricting the use of groundwater beneath OU3.
- fencing of Site 7.
- placing warning signs along the fence and Slocum Creek and Luke Rowe's Gut within Site 7.
- monitoring of groundwater under OU3, soil at Site 7, and surface waters and sediments in Slocum Creek and Luke Rowe's Gut, as per State and Federal requirements.
- complying with OSHA regulations during (future) construction at Site 6, and the construction of the fence along Site 7.

The records on the presence of contamination at OU3 and the specific restrictions for site use listed above (including land use and groundwater use restrictions) will be recorded in the Air Station's Base Master Plan and will ensure that, at the time of future land development, MCAS Cherry Point will be able to take adequate measures to minimize adverse human health and environmental effects.

The fencing and warning signs will be installed to restrict access to Site 7 and, therefore, minimize human exposure to contaminated media (soil with lead at concentrations above 1,300 mg/kg) (approximately 260,000 square feet). The warning signs will be installed along the fence and along the banks of Slocum Creek and Luke Rowe's Gut. The area to be fenced is shown on Figure 11-1.

Monitoring will consist of the sampling of groundwater at Sites 6 and 7 to assess contaminant migration and the progress of the natural attenuation of the groundwater. The results of the groundwater monitoring will be compared to the North Carolina groundwater standards. Monitoring will also consist of the sampling of soil at Site 7. The results will be compared to the soil RGOs developed for the protection of groundwater (benzene - 15 μg/kg; 2-methylnaphthalene - 8,570 μg/kg) to assess the progress of the bio-remediation of the soil. Monitoring will also consist of the sampling of the surface water and sediments in Luke Rowe's Gut and Slocum Creek to assess the migration of contaminants from OU3 into the environment. The results of the monitoring of the surface water will be compared to the North Carolina surface water standards, whereas the results of the monitoring of the sediment samples will be used to confirm that surface soil runoff is not a continuing problem in Luke Rowe's Gut and Slocum Creek. As noted in Section 8, Slocum Creek is now considered a separate Operable Unit. Monitoring of the surface water and sediment in Slocum Creek will be used to further evaluate conditions in Slocum Creek. A monitoring plan will be developed according to appropriate Federal and State regulations. Based on the results of the monitoring, additional sampling and analysis and/or additional remedial actions may be required.



ESTIMATED EXTENT OF SOIL CONTAMINATED WITH LEAD
SITE 7, OU3
MCAS CHERRY POINT, NORTH CAROLINA

FIGURE 11-1

Brown & Root Environmental

REVISION 1
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Any future construction activity at Site 6, along with the construction of the fence around Site 7, must be conducted in compliance with OSHA requirements, a condition which would minimize the potential for contaminants to enter the exposure pathways (mainly incidental ingestion) for construction workers on site. The OSHA requirements are especially important for construction of the fence at Site 7 because of the presence of significant surface soil contamination at levels that are expected to pose a threat to worker health.

Since active treatment of the contaminated groundwater is not being proposed, natural attenuation of the groundwater is an inherent component of this alternative. During the public comment period, NCDEHNR noted that their regulations require that secondary sources of groundwater contamination (contaminated soil) be treated, removed, or controlled as part of the natural attenuation process. Consequently, enhanced bioremediation of soils containing elevated levels of fuel-related compounds will be conducted at Site 7 to meet these requirements (See Section 13).

11.2 ESTIMATED COSTS

The estimated net present worth of Alternative 2 is $470,000, with a capital cost of $27,000, an annual O&M cost of $22,000, and a 5-year cost (for the site review) of $40,000. The capital cost is associated with installation of fencing and posting of warning signs. The annual costs are for groundwater, surface water and sediment monitoring.

It should be noted that the cost estimate was calculated for the FS evaluation and should not be considered a construction-quality cost estimate. An FS cost estimate should have an accuracy of +50 or -30 percent. The remedy could change somewhat as a result of the remedial design and construction process. Such changes, in general, reflect modification resulting from the engineering design process (e.g., frequency of repair of fencing and signs). In addition, the monitoring program will be developed at the remedial design stage and could be revised during the 5-year reviews as a result of evaluation of the data collected.

It should also be noted that the cost estimate does not include the cost of the enhanced bioremediation of soil containing elevated levels fuel-related compounds.

12.0 STATUTORY DETERMINATIONS

Under CERCLA Section 121, selected remedies must be protective of human health and the environment, comply with ARARs, be cost effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practical. In addition, CERCLA includes a preference for remedies that employ treatment that significantly and permanently reduces the volume, toxicity, or mobility of hazardous wastes as their principal element.

12.1 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Buried waste/fill and contaminated surface soils at Site 7 present the greatest risk to human health and the environment of any component of OU3 based on the current land use scenario. Contaminated groundwater at OU3 presents the greatest risk to human health and the environment of any component of OU3 based on a future residential land use scenario. The selected remedy protects human health and the environment through the use of institutional controls, fencing, and monitoring to prevent potential exposure to contaminated soil and groundwater and to restrict future use of OU3. Land use restrictions would prevent future residential use of OU3; aquifer use restrictions would prevent the installation of wells (other than for monitoring) and the use of contaminated groundwater; and fencing and warning signs would control unauthorized uses of Site 7. Monitoring would provide a means of evaluating future releases of hazardous constituents from buried waste materials to the environment and of evaluating the effectiveness of the natural attenuation of the groundwater and bioremediation of the soil. The enhanced bioremediation of the soil might provide a measure of protection to the environment by treating a secondary source of groundwater, thereby potentially shortening the length of time required for the natural attenuation of the groundwater. Implementation of institutional controls and monitoring would not pose unacceptable short-term risks. The monitoring program would evaluate the potential for future unacceptable contaminant concentrations or cross-media impacts.

12.2 COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Groundwater under its current classification exceeds state groundwater quality standards for several contaminants. However, the selected remedy of institutional controls and monitoring would attain compliance with chemical-specific ARARs through natural attenuation processes (if the changes noted in Section 13 are added to the selected remedy). Although natural attenuation of the groundwater may take a long time, implementation of this remedy may be justified for the following reasons: the groundwater in

the surficial aquifer is not currently used as a source of drinking water, the Air Station has a separate potable water supply, groundwater at OU3 does not discharge to a potable groundwater aquifer, and the remedy is cost effective. Again, the enhanced bioremediation of the soil, required under State regulations, may shorten the length of time needed for natural attenuation of the groundwater.

There are no location- or action-specific ARARs associated with the selected remedy. However, the requirements of the Occupational Safety and Health Administration would be followed for all site activities.

12.3 COST EFFECTIVENESS

The estimated capital cost and present worth of $27,000 and $470,000, respectively, for the selected remediation plan for OU3 are less than for all but one of the other proposed alternatives. Only the corresponding cost for the No Action alternative is less than the values noted above. The costs for implementing the changes noted in Section 13 (enhanced bioremediation of the soil) will be in addition to the costs noted here.

12.4 UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES TO THE MAXIMUM EXTENT POSSIBLE

The selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be used in a cost-effective manner for OU3. Of those alternatives which are protective of human health and the environment and comply with ARARs, the selected remedy provides the best balance of trade-offs in terms of long-term effectiveness and permanence; reduction in toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost, while also considering the statutory preference for treatment as a principal element and considering USEPA/state and community acceptance.

The selected alternative would provide permanent, long-term remedy through provision and enforcement of institutional controls in the Air Station's Base Master Plan to restrict entry to Site 7 (maintain as vacant land), to prohibit installation of wells, and to limit Site 6 to nonresidential and/or industrial type uses.

Treatment technologies for remediation of the soils contaminated with metals were considered in the FS when developing and evaluating remedial alternatives for OU3. However, the extra protection that these alternatives provide through active remediation (treatment) systems is not necessary, considering the minimal risks, except under a hypothetical future residential scenario, or hypothetical future construction worker scenario, associated with exposure to the soils. There are no plans to develop OU3 as a residential area. Considering the minimal risks under proposed exposure scenarios, institutional controls and monitoring will be adequate for protection of human health and the environment. Although groundwater

discharges to surface water bodies, these streams do not appear to be adversely affected from this discharge.

12.5 PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

The selected remedy does not satisfy the preference for treatment. For the reasons discussed in Section 12.4, use of treatment technologies was considered not to be appropriate or necessary for providing protection of human health and the environment under proposed exposure scenarios.

13.0 DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Remedial Action Plan (PRAP) for Operable Unit 3 was released for public comment on August 1, 1996. The PRAP identified Alternative 2, Institutional Controls at Site 6 and Site 7, as the preferred alternative for remediation. The Navy reviewed all written and verbal comments submitted during the public comment period. Upon review of these comments, it was determined that one significant change to the remedy, as originally identified in the PRAP, was necessary.

The significant change proposed here for the selected remedy is based on comments received from the State of North Carolina during the public comment period. Natural attenuation of the groundwater was an inherent component of Alternative 2. The State of North Carolina noted during the public comment period that in order for natural attenuation of groundwater to be an acceptable option, secondary sources of groundwater contamination (contaminated soil) would be required to be treated, disposed of, or controlled (as required in State regulations).

Calculations were made to determine soil concentrations that would be protective of the groundwater. These calculations were made for all contaminants detected in the groundwater at levels above State groundwater standards. In addition, soil concentrations were calculated for ethylbenzene and xylenes. These calculations were conducted using the ECTran model that was used in the FS to calculate soil concentrations protective of surface water.

The soil concentrations calculated to be protective of the groundwater were compared to the concentrations detected in the soil at Site 7. Several soil samples contained contaminants above the concentrations calculated for the protection of groundwater. In discussions with the State of North Carolina, it was determined that the area in the vicinity of sample locations OU3SB02, OU3SB06 and OU3SB10 would be the area of soil contamination that would have to be addressed as a secondary source of groundwater contamination. This area was selected because of the presence of contaminants above the concentrations calculated to be protective of groundwater (benzene - 15 μg/kg; 2-methylnaphthalene - 8,570 μg/kg) and it is in an area of groundwater containing those contaminants above the State's groundwater standards. This area measures approximately 200 feet by 70 feet and extends 4 feet below the ground surface (14,000 square feet, 2,100 cubic yards).

The area identified above will be remediated via enhanced in-situ bioremediation. The details for this remedial activity will be determined during the pre-design phase.

Data collected during the pre-design phase of the fence construction indicated the presence of lead above 1,300 mg/kg in areas of the eastern portion of Site 7. Consequently, all of Site 7 will now be fenced and the Institutional Controls limiting land use to vacant land will be expanded to include all of Site 7.

14.0 RESPONSIVENESS SUMMARY

14.1 BACKGROUND ON COMMUNITY INVOLVEMENT

Community relations activities to date are summarized below:

- Established information repositories.
- Established the Administrative Record for all of the sites at the Air Station.
- Released the Proposed Remedial Action Plan for public review in repositories.
- Released public notice announcing public comment and document availability of the Proposed Remedial Action Plan.
- Held public meeting on August 22, 1996 to solicit comments and provide information. No community members attended the formal public meeting. The public meeting transcript is available in the repositories and is included in Section 14.2.

  In addition to the public meeting held on August 22, 1996, a Restoration Advisory Board (RAB) meeting was held prior to the public meeting. Comments on the Proposed Plan were made by members of the RAB. Minutes of the RAB meeting (including comments and responses) are also included in Section 14.2.

  In addition, as noted in Section 13, the State of North Carolina also commented on the proposed plan. The remediation of secondary sources of groundwater contamination will be added to the selected alternative.

14.2 SUMMARY OF COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD AND AGENCY RESPONSES

This section includes the transcript of the public meeting held on August 22, 1996, as well as, the minutes of the RAB meeting held prior to the public meeting.

TRANSCRIPT OF PUBLIC MEETING
OU3 REMEDIAL ALTERNATIVE
AUGUST 22, 1996

COPY

STATEMENT OF WORK
MARINE CORP AIR STATION CHERRY POINT
CTO 238

PUBLIC MEETING
CITY OF HAVELOCK
1 HATTERAS AVENUE
HAVELOCK, NORTH CAROLINA

T-R-A-N-S-C-R-I-P-T

* *

TRANSCRIPT OF PUBLIC MEETING TAKEN IN THE CITY OF HAVELOCK, CRAVEN COUNTY, NORTH CAROLINA, AT THE HAVELOCK CITY AUDITORIUM, BEGINNING AT 8:00 P.M., THURSDAY, AUGUST 22, 1996.

INTRODUCTIONS - CAPTAIN JEFF HEARN
PUBLIC AFFAIRS OFFICE AT CHERRY POINT

PRESENTER - MR. GREG ZIMMERMAN
BROWN & ROOT ENVIRONMENTAL

COORDINATOR - MS. BETSY HORNE
COMMUNITY RELATIONS SPECIALIST
BROWN & ROOT ENVIRONMENTAL
55 JONSPIN ROAD
WILMINGTON, MAINE 01887-1062

COURT REPORTER - DEBBIE HADDOCK NICHOLS

CAROLINA COURT REPORTERS, INC.
102 Oakmont Professional Plaza
Greenville, North Carolina 27858
TEL: (919) 355-4700 (800) 849-8448
FAX: (919) 355-2100

INDEX OF POSTER BOARD EXHIBITS

CAPTAIN HEARN: RIGHT NOW IS THE OFFICIAL PART OF THE PUBLIC ENVIRONMENTAL MEETING. WHAT WE HAVE HERE IS BROWN AND ROOT ENVIRONMENTAL GROUP READY TO PRESENT THE PROPOSED REMEDIAL ALTERNATIVE PLAN FOR OPERABLE UNIT 3. FIRST OFF, I'D LIKE TO TAKE CARE OF SOME FORMALITIES. I AM THE PUBLIC AFFAIRS OFFICER FROM CHERRY POINT, CAPTAIN JEFF HEARN. LET ME LAY SOME GROUND RULES FOR THIS MEETING. NUMBER ONE, IF YOU WOULD LIKE TO MAKE PUBLIC COMMENT, THERE ARE THREE WAYS TO DO THAT. YOU CAN STAND, PLEASE RECOGNIZE YOURSELF, AND FROM THERE ASK YOUR QUESTION. SECONDLY, IF YOU DO NOT FEEL COMFORTABLE IN SPEAKING IN THIS FORUM, THERE IS A COMMENT CARD. PLEASE PUT YOUR NAME, YOUR ADDRESS, AND YOUR COMMENT, AND PUT IT OVER IN THE BOX--THE GREEN BOX IN THE CORNER OF THE ROOM. THEN YOUR COMMENT WILL BE ANSWERED. THIRDLY, YOU CAN SEND IT TO MY OFFICE, THE PUBLIC AFFAIRS OFFICE, MARINE CORPS AIR STATION, CHERRY POINT, PSC BOX 8013, CHERRY POINT, NORTH CAROLINA, 28533. THOSE ARE THE THREE WAYS TO MAKE COMMENTS. BROWN & ROOT IS PREPARED TO GIVE THEIR PRESENTATION AT THIS TIME. IS THERE ANY INTEREST IN THE PUBLIC TO HEAR THEIR PRESENTATION? LET THE RECORD SHOW THAT NO ONE MADE COMMENT. AT THIS TIME, I AM OPENING THE FLOOR FOR OFFICIAL COMMENT ON THE PROPOSED REMEDIAL ALTERNATIVE PLAN FOR OU-3. LET THE RECORD SHOW THAT THERE IS NO COMMENT. SINCE THERE IS NO PUBLIC COMMENT, WHAT I WOULD LIKE TO DO IS TURN THIS MEETING BACK TO THE INFORMAL MEETING

AND CONTINUE WITH THE RESTORATION ADVISORY BOARD FORUM.

THANK YOU.

* *

PROCEEDINGS CONCLUDED AT 8:15 P.M.

STATE OF NORTH CAROLINA)

) C-E-R-T-I-F-I-C-A-T-I-O-N

COUNTY OF PITT)

I, DEBBIE HADDOCK NICHOLS, A COURT REPORTER AND NOTARY PUBLIC IN AND FOR THE AFORESAID COUNTY AND STATE, DO HEREBY CERTIFY THAT THE FOREGOING PAGES ARE AN ACCURATE TRANSCRIPT OF THE HAVELOCK PUBLIC MEETING, WHICH WAS TAKEN ON BEHALF OF BROWN & ROOT ENVIRONMENTAL, BY ME BY STENOMASK, AND TRANSCRIBED BY ME PERSONALLY.

WITNESS, MY HAND AND SEAL, THIS DATE: AUGUST 28, 1996.

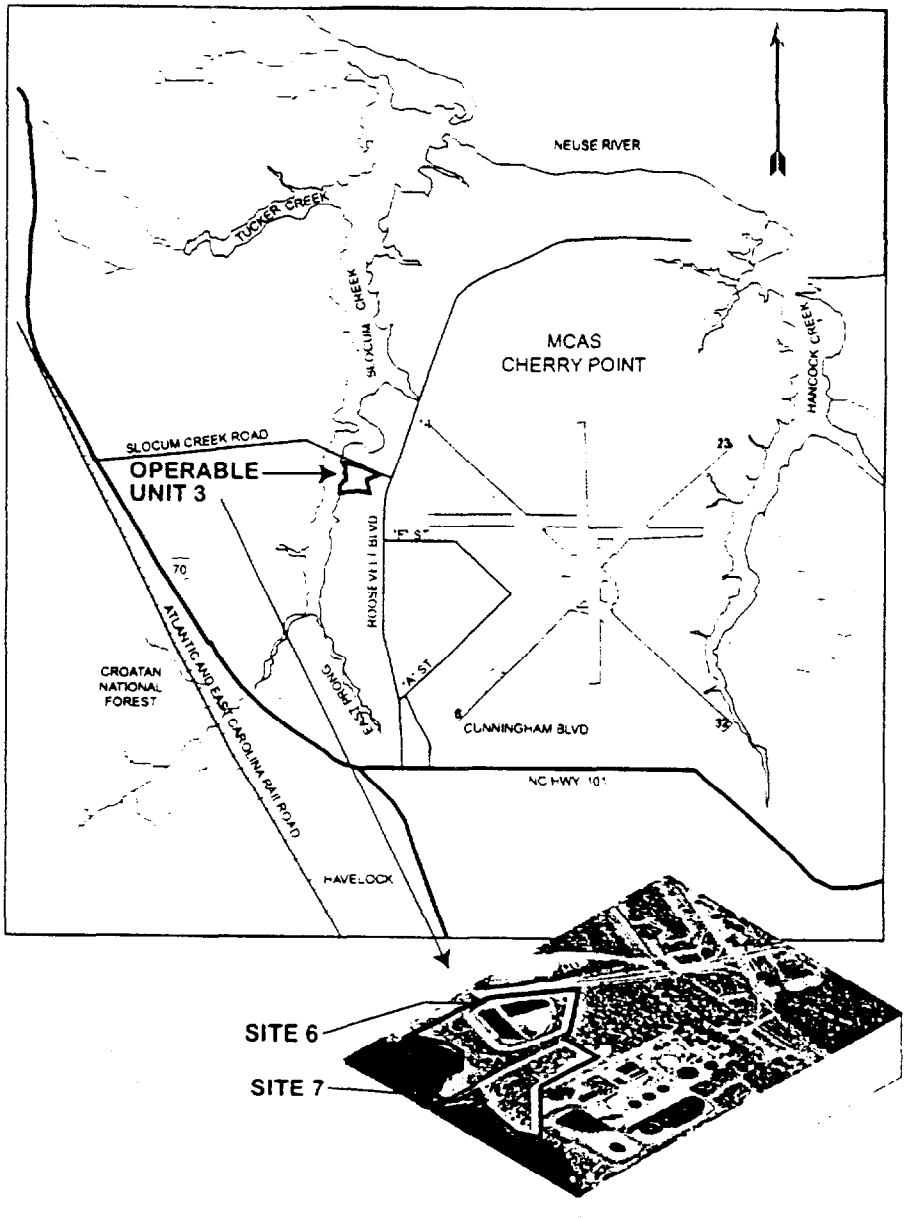
MY COMMISSION EXPIRES JUNE 26, 2000.

Debbie Haddock Nichols

DEBBIE HADDOCK NICHOLS
COURT REPORTER AND NOTARY PUBLIC
CAROLINA COURT REPORTERS, INC.
102 OAKMONT PROFESSIONAL PLAZA
GREENVILLE, NC 27858

MCAS Cherry Point

Public Meeting
August 22, 1996



Operable Unit 3
Proposed Remedial Alternative Plan (PRAP)

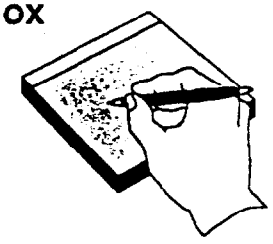
How to Comment

MCAS Cherry Point

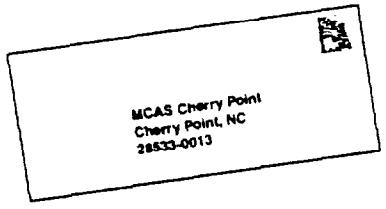
You can comment on the information presented by:

- Voicing your opinion during this meeting

- Writing your comments on a card and leaving them in the comment box



- Submitting your comments in writing, before August 30, 1996, to:

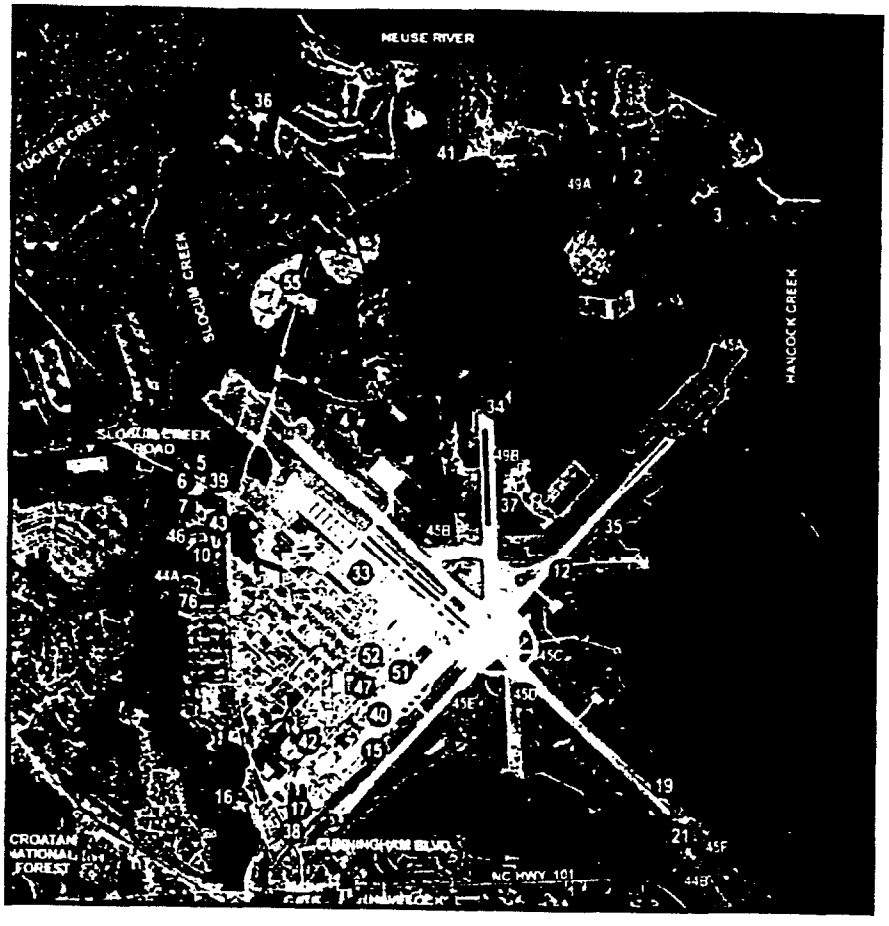


Public Affairs Officer
MCAS Cherry Point, NC 28533-0013
(919) 466-2536/4241

All comments will be answered in the responsiveness summary accompanying the ROD.

Aerial View

MCAS Cherry Point

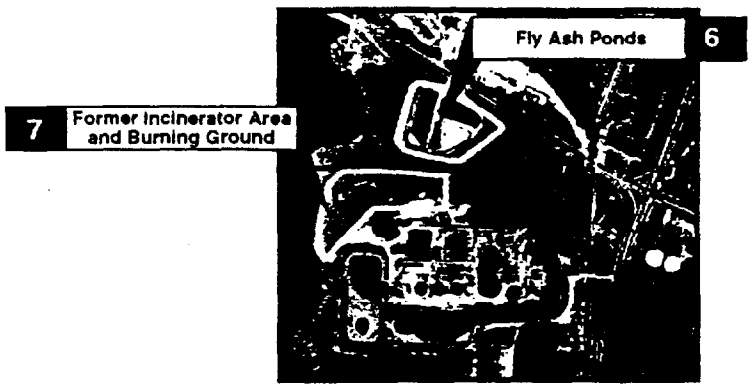


Site	OU	Description
1	5	Borrow Pit/Landfill
2	5	Borrow Pit/Landfill
3	11	Explosive Ordnance Disposal (EOD)
4	4	Borrow Pit/Landfill North of Runway 14
5	8	Petroleum, Oil and Lubricant (POL) Storage Tank
6	3	Fly Ash Ponds
7	3	Former Incinerator Area and Burning Ground
10	2	Old Sanitary Landfill
12	6	Crash Crew Training Area and Oil/Water Separator
15	1	Area and Ditch Behind NADEP
16	1	Landfill at Sandy Branch
17	8	DRMO Drainage Ditch
19	5	Borrow Pit/Landfill North of Runway 32
21	13	Borrow Pit/Landfill South End of Runway 32
33	10	Marine Aerial Refueler Transport Squadron (VMGR) 252 Accumulation Area
34	10	Crash Crew Accumulation Area
35	10	Main Aircraft Group (MAG) 14 Accumulation Area

Site	OU	Description
36	10	Headquarters and Headquarters Squadron (H&HS) Former Accumulation Area
37	9	Marine Wing Communications Squadron (MWCS) 28 Accumulation Area
38	11	Defense Reutilization Marketing Office (DRMO) Hazardous Waste Storage Area
39	11	Facilities Maintenance/Hazardous Waste Storage Area
40	1	NADEP Former Drum Storage Area
42	1	Industrial Wastewater Treatment Plant (IWTP)
43	11	Sewage Treatment Plant
44A	2	Former Sludge Application Area
44B	13	Former Sludge Application Area
45A-F	11	Current Sludge Application Area
46	2	Polishing Ponds 1 & 2
47	1	Industrial Sewer System
49A 49B	9	Oil/Water Separators and Leach Fields
51	1	Building 137 Plating Shop
52	1	Building 133 Plating Shop and Ditch
55	7	Third Light Anti-Aircraft Missiles (LAAM) Area
76	2	Vehicle Maintenance Area (Hobby Shop)

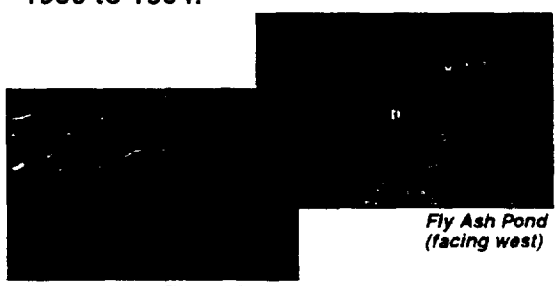
Operable Unit 3

MCAS Cherry Point



Site 6
Fly Ash Ponds

- Three 10-ft. deep ponds on 2.5 acres.
- Disposal site for fly ash and cinders from 1940s to 1970 and lime alum sludge from potable water treatment - 1980 to 1994.



Fly Ash Pond (facing west)

Oblique View of Fly Ash Ponds

Site 7
Former Incinerator Area and Burning Ground

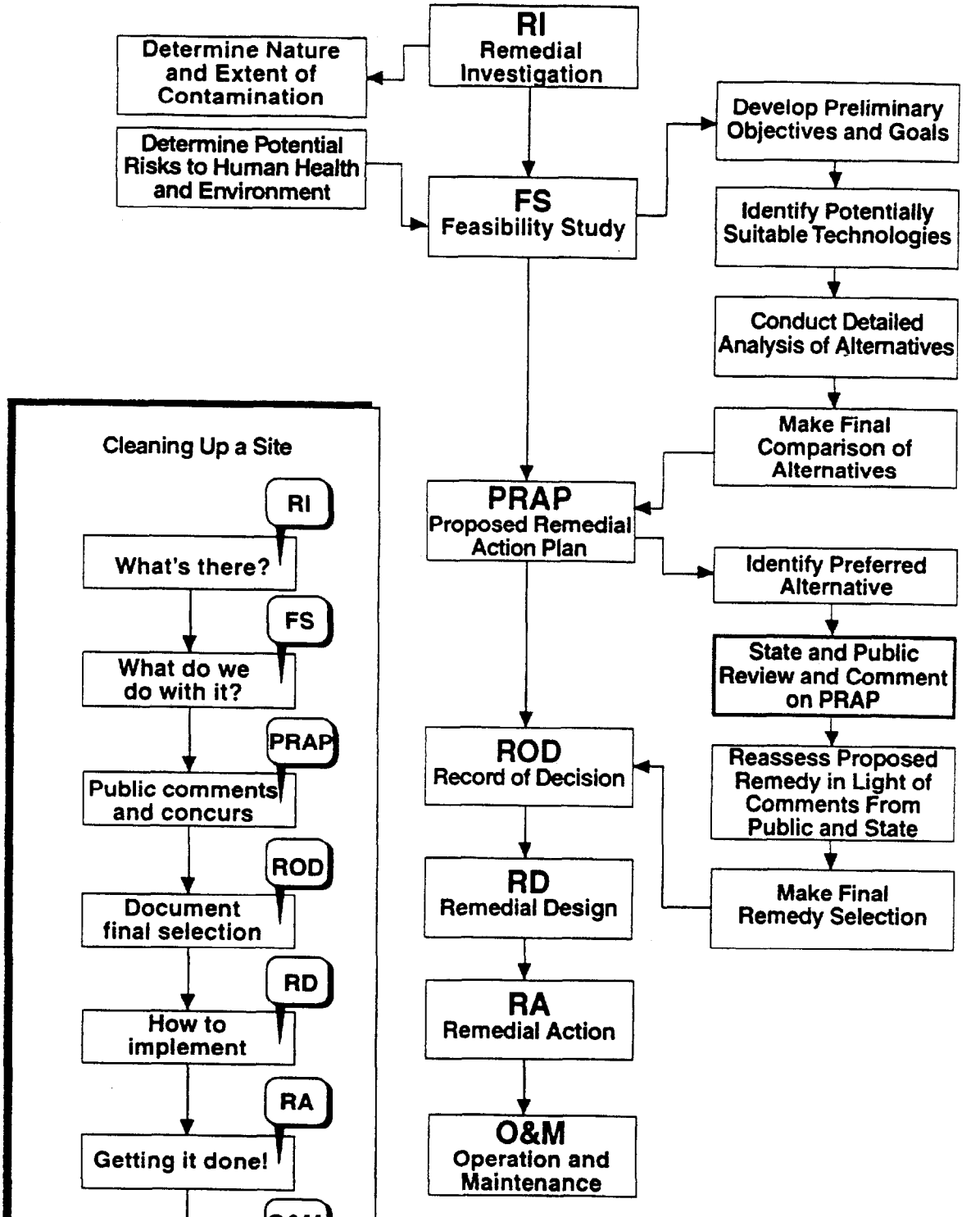
- Incinerator and open-burning ground areas covering 5 acres.
- Waste petroleum, oils, and lubricants; NADEP wastes; and municipal refuse, burned either in the incinerator or on the ground from 1949 to 1955. Fly ash deposited on ground.

Former Incinerator Area (facing west)

Luke Rowe's Gut Dividing Sites 6 & 7

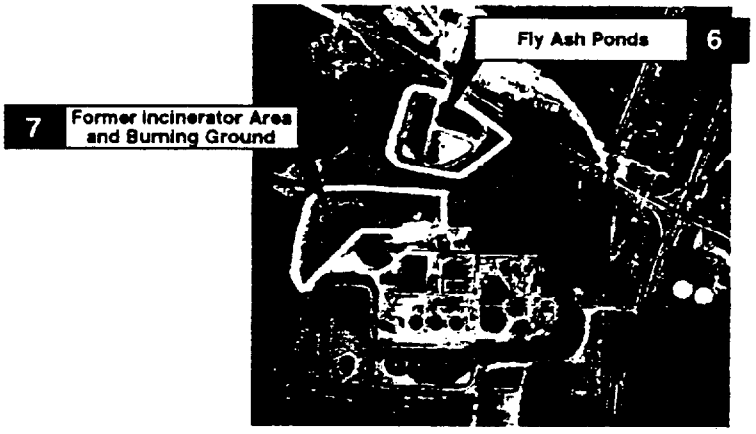
Superfund Process

MCAS Cherry Point



Operable Unit 3
Remedial Investigation

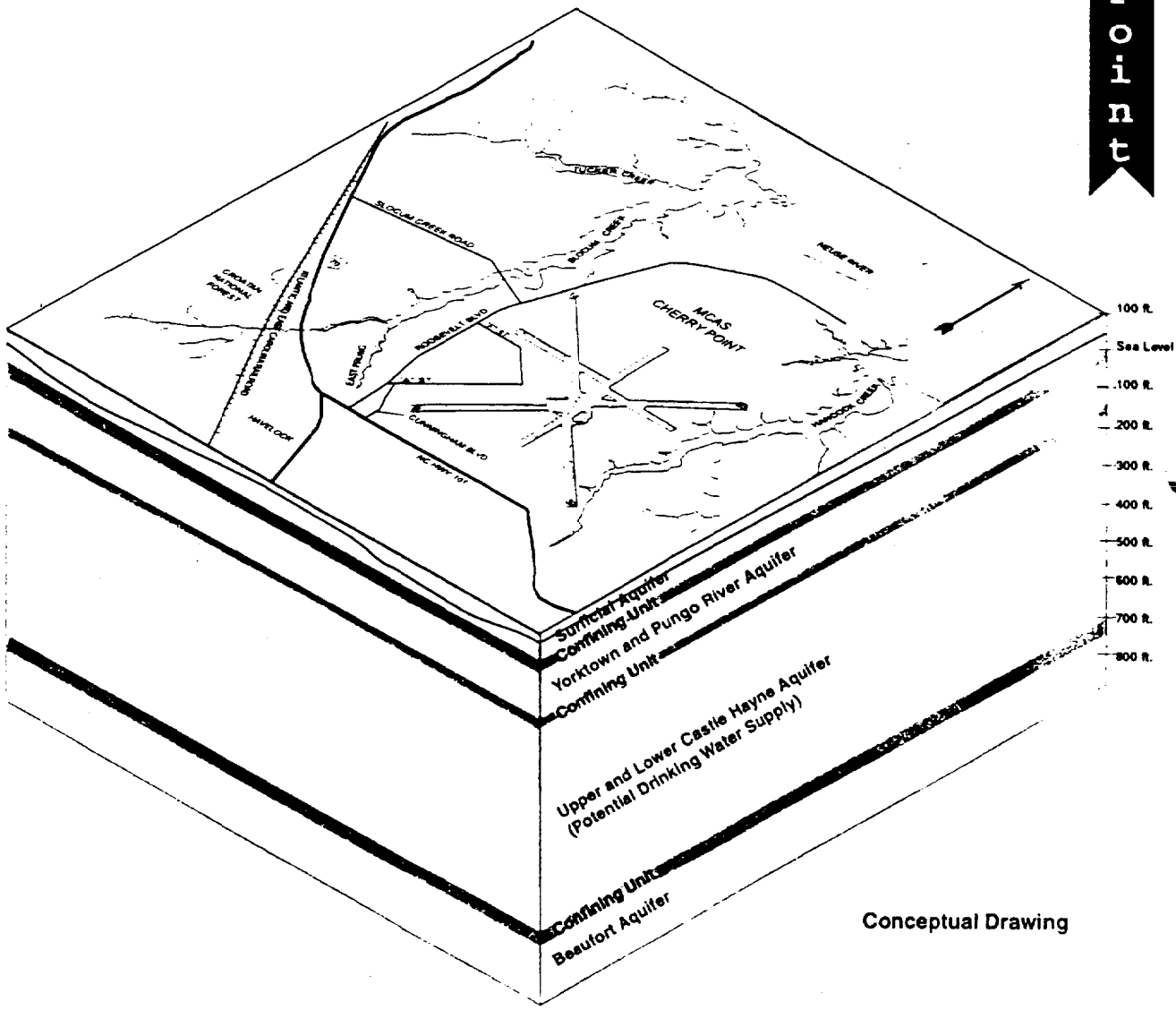
MCAS Cherry Point



Media	Site 6	Site 7
Surface Soil	No contamination that presents an unacceptable risk to human health and the environment under current land use.	Contaminants include polycyclic aromatic hydrocarbons (PAHs), dioxins, metals in a sporadic pattern.
Subsurface Soil	No contamination that presents an unacceptable risk to human health and the environment.	Contamination found in area between Luke Rowe's Gut and Slocum Creek. Contaminants include metals, PAHs, dioxins; fuel in isolated area.
Groundwater	Contaminants include metals	Contaminants include benzene, metals.
	Luke Rowe's Gut	**Slocum Creek**
Surface Water	No contamination that presents an unacceptable risk to human health and the environment.	No contamination that presents an unacceptable risk to human health and the environment.
Sediment	No contamination that presents an unacceptable risk to human health and the environment.	No contamination that presents an unacceptable risk to human health and the environment.

MCAS Cherry Point Basewide Geology

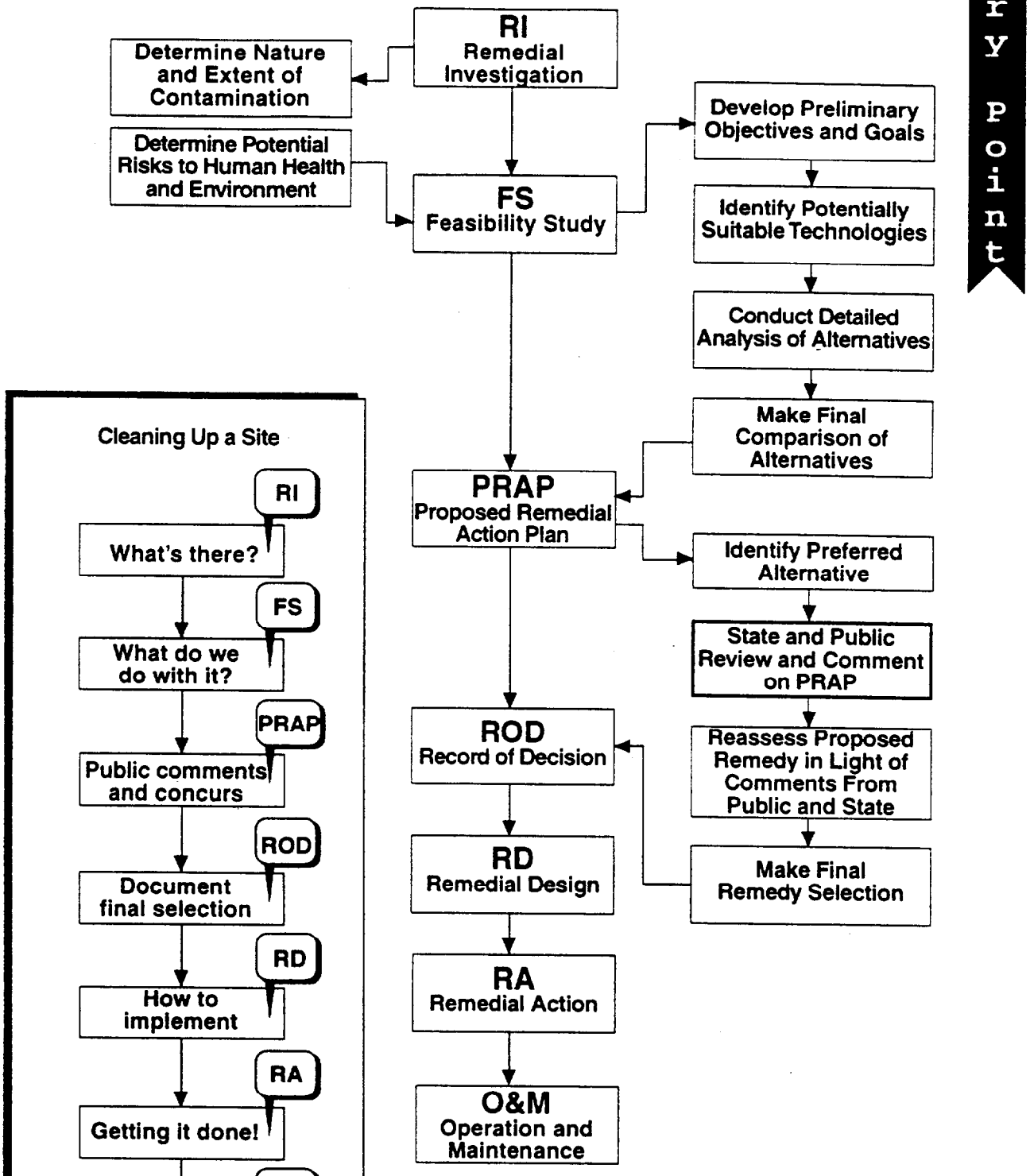
MCAS Cherry Point



Conceptual Drawing

Superfund Process

MCAS Cherry Point



Alternative Evaluation Criteria

MCAS Cherry Point

1. Overall Protectiveness of Human Health and the Environment

2. Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)
3. Long-Term Effectiveness
4. Reduction of Toxicity, Mobility, or Volume Through Treatment
5. Short-Term Effectiveness and Permanence
6. Implementability

7. Cost

After Public Comment

8. USEPA/State Acceptance
9. Community Acceptance

Operable Unit 3
Remedial Alternatives

MCAS Cherry Point

Alternatives Considered

1. Sites 6 and 7: No Action
2. Sites 6 and 7: Institutional Controls
3. Site 7: In-situ Fixation/Solidification of Surface Soils
   Sites 6 and 7: Institutional Controls

4. Site 7: Excavation and Offsite Disposal of Surface Soils
   Sites 6 and 7: Institutional Controls
5. Site 7: Excavation, Onsite Ex-situ Fixation/Solidification, and Reuse of Surface Soils as Fill
   Sites 6 and 7: Institutional Controls
6. Site 7: Soil Cover
   Sites 6 and 7: Institutional Controls
7. Site 7: Partial Dewatering, Excavation and Offsite Disposal of Surface/Subsurface Soils

   Sites 6 and 7: Institutional Controls

✔ Identify Preferred Alternative

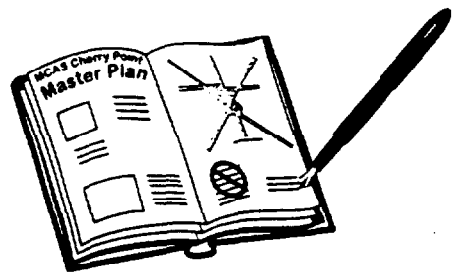
2. Sites 6 and 7: Institutional Controls

Operable Unit 3
Preferred Alternative

MCAS Cherry Point

Institutional Controls

1. Maintain records of contamination in MCAS Cherry Point Master Plan.
2. Restrict or limit use of surficial aquifer and an area of Site 7 in MCAS Cherry Point Master Plan.



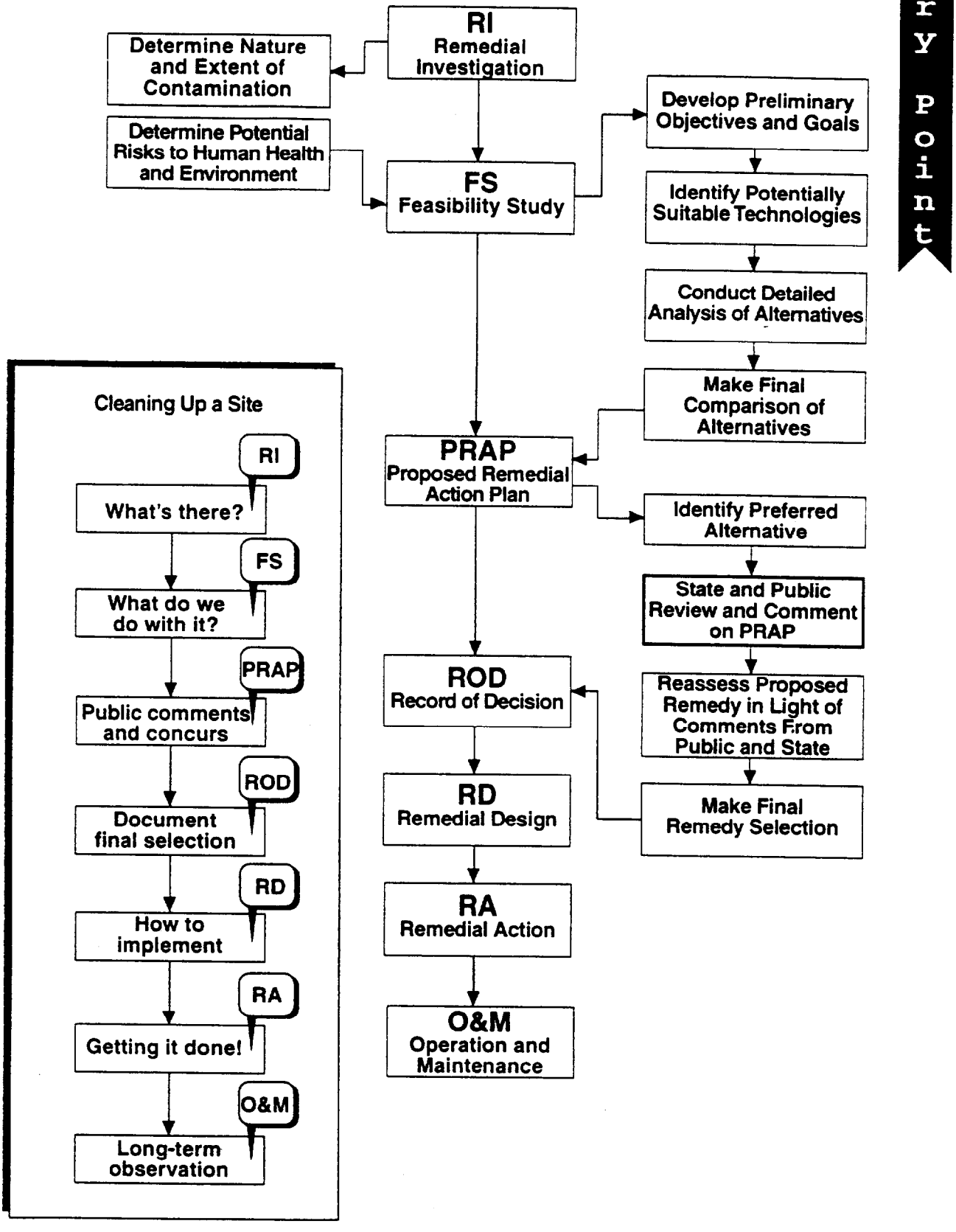
3. Monitor groundwater and assess need, if any, for future actions.
4. Install fencing and post warning signs around a portion of Site 7.

Objectives

1. Prevent potential exposure to contaminated soil and fill material.
2. Prevent potential exposure to contaminated groundwater in the surficial aquifer.
3. Prevent future potential use of the surficial aquifer.
4. Restrict current and future use of Site 7.

Superfund Process

MCAS Cherry Point



MINUTES OF RESTORATION ADVISORY BOARD MEETING
OU3 REMEDIAL ALTERNATIVE
AUGUST 22, 1996

CHERRY POINT MARINE CORPS AIR STATION
RESTORATION ADVISORY BOARD MEETING
AUGUST 22, 1996
MINUTES

The RAB meeting was held at the Havelock City Auditorium, to be followed by a public meeting on the preferred alternative for OU3. Community members present were Grace Evans, Pat McClellan-Green, and Neil Scarborough; Navy and Marine Corps members Lance Laughmiller (LANTDIV), Renee Henderson, and Rachel Johnson (MCAS CP EAD); regulatory members Linda Raynor and Richard Powers (NCDEHNR), and Gena Townsend and her successor, Jay Bassett (EPA); and Natural Resource Trustee Alex Cardinell (USGS). Also present were Waverly Hampton (LANTDIV); Marybeth Fennell (EAD); Cynthia Tschaepe (OHM); Susan Dubuque (Management Edge); and Matt Cochran, Greg Zimmerman, and Betsy Horne (B&RE). Henry Sermons had called to say he was on vacation. Other community members not present were Lew Mitchell and Gene Smith. The meeting began at 7:05 pm and ended at 8:00 pm.

Rachel Johnson, the Marine Corps Co-Chair, began by asking if the members had received the last meeting's minutes, which stated that Grace Evans had been elected Community Co-Chair. Rachel emphasized the importance of each member contacting either Grace or Rachel if they were going to be unable to attend a RAB meeting.

Rachel also reviewed some housekeeping issues:

Those RAB members who did not sign the charter that was adopted at the last RAB meeting need to do so. The sheet was passed around for signatures. Linda Raynor promised to obtain Beth Hartzell's signature and return the original sheet to Rachel.

Rachel asked that each member identify an issue or concern that should be the focus of a RAB presentation or workshop. A sheet was passed around to record these issues. Those proposed include: risk to fish, bioaccumulation, DoD risk evaluation, human health risk assessment, cost controls, hydrology, remediation methods, and basic chemistry including degradation (dioxin, arsenic, PCBs. Jay Bassett will obtain ATSDR sheets on the list of contaminants that Rachel provides).

Rachel and Grace are anxious to enhance MCAS Cherry Point's community outreach program. Rachel passed around examples of fact sheets other bases have created and requested suggestions from the RAB members.

OU3 Presentation

Greg Zimmerman opened his presentation by indicating how MCAS Cherry Point would accept public comment on the proposed approach to OU3: by receiving oral comment at the public meeting scheduled to follow the RAB meeting, by considering comments written on a card at

the meeting, or by receiving written comment addressed to the MCAS Cherry Point Public Affairs Office no later than August 30.

Greg placed the OU3 action in perspective by stating that the meeting would be the third scheduled to elicit public comment on a proposed remedial approach to cleaning up discrete areas of contamination at the Air Station. The first was to address PCBs at Sites 5 and 17; the second, in June, was for OU1 groundwater contamination.

OU3 is comprised of Sites 6 and 7, combined because of their proximity and similarity of contamination. Site 6's three ponds were used from the 1940s to 1970s to dispose of fly ash from the power plant and from 1980 to 1994 of lime alum sludge from the drinking water treatment plant. Site 7, used from 1949 to 1955, was where waste petroleum and lubricants were burned, either in an incinerator or on the ground. Fly ash was disposed on the western portion of Site 7 that is now overgrown.

Greg reviewed the Superfund process: the remedial investigation studies the problem to determine the type of contamination present and how widespread it is; that information is the basis for the feasibility study, which identifies cleanup objectives, analyzes remedial technologies, evaluates the technologies against the nine EPA-mandated selection criteria; this information is used to develop a proposed remedial action plan, which presents all the foregoing in a short straight-forward document that also identifies the alternative that MCAS Cherry Point prefers to address site contamination. Once a public comment period is held on the proposal, a record of decision on the plan is signed, selecting the remediation approach that will be used. A period to design the remedial approach is followed by the cleanup action itself and long-term monitoring to ensure that the remedy is working as designed.

For OU3, MCAS Cherry Point has undertaken four major investigations and two supplemental studies to collect samples of soil, groundwater, surface water and sediment from Luke Rowe's Gut and Slocum Creek, as well as lime alum sludge. Analysis revealed:

Site 6 - metals, pesticides, and dioxin (soil)
metals, pesticides (groundwater)

Site 7 - metals, PAHs, pesticides, and VOCs (soil)
metals, pesticides, PAHs, and VOCs (groundwater at levels above the State of North Carolina standards)

The human health risk assessment was conducted using the latest guidance from EPA, including evaluating current and future land uses and receptors. Maintenance workers and adolescent trespassers were the receptors evaluated under the current land use (vacant land). Construction workers, full-time employees, and adult/child residents were the receptors evaluated under a future land use (industrial and residential) scenario. These land uses were evaluated even though MCAS Cherry Point is not planning on using the land at OU3 for those purposes. Adult recreational users of Slocum Creek were also evaluated.

The results of the human health risk assessments indicated that no "unacceptable risks" exist under current conditions and that the only receptors exposed to "unacceptable risks" were the construction workers at Site 7 and the adult/child residents at both Sites 6 and 7. The risks

would be the results of drinking the groundwater in the surficial aquifer. The surficial aquifer at MCAS Cherry Point is currently not used.

In addition, lead was detected in the soil at Site 7 at levels above EPA screening levels for soils in industrial and residential settings.

The ecological risk assessment evaluated the effect of the contamination on the eastern cottontail rabbit, the red fox, and the red tail hawk.

Greg reviewed the nine criteria EPA has established against which each alternative must be evaluated. Seven alternatives were considered in the feasibility study. These include:

1. Sites 6 and 7: No action

2. Sites 6 and 7: Institutional controls

3. Site 7: In-situ fixation/solidification of surface soils; Sites 6 and 7: Institutional controls

4. Site 7: Excavation and offsite disposal of surface soils: Site 6 and 7: Institutional controls

5. Site 7: Excavation, onsite ex-situ fixation/solidification and reuse of surface soils as fill; Sites 6 and 7: Institutional controls

6. Site 7: Soil cover; Sites 6 and 7: Institutional controls

7. Site 7: Partial dewatering, excavation, and offsite disposal of surface/subsurface soils; Sites 6 and 7: Institutional controls

The proposed approach is to implement alternative 2, institutional controls, which includes enclosing a portion of Site 7 with an 8-foot fence and posting warning signs in the area, as well as instituting long-term monitoring for OU3. Limits on the use of the surficial aquifer and portions of Site 7 would be memorialized in the MCAS Cherry Point Master Plan. The Plan is similar to a zoning map, detailing each area of the Station and what plans exist for them. Greg added that the objectives of the remediation were to prevent people from being exposed to the contaminated soil or the contaminated groundwater now or in the future. In addition, since the State has identified an area of soil with high benzene content coinciding with a plume of benzene in the groundwater, MCAS Cherry Point will begin to evaluate alternatives to remediate that area.

Comment from Pat McClellan-Green: She has a number of environmental management students for the academic year that would benefit from having a workshop on the MCAS Cherry Point IR program. One of them may also be interested in interning for the IR program.

Response by Rachel Johnson: Rachel and Renee will contact her directly to discuss both matters.

Question from Alex Cardinell: Was there a head differential between the Surficial Aquifer and the Yorktown Aquifer at OU3?

Response by Greg Zimmerman: Yes. It is a situation we have encountered throughout MCAS Cherry Point near surface water bodies.

Question from Grace Evans: Was there a comparison made of contaminant levels between the surface and subsurface soil? What effect might it be having?

Response by Greg: The fly ash was deposited in the 1950s and has been exposed to the elements for the last 40 years. All soil samples were collected in the space from the top of the water table to the soil surface. There was not much difference in levels and it does not appear that Luke Rowe's Gut or Slocum Creek are being impacted. Groundwater samples indicate very low contaminant levels are present. Linda Raynor added that benzene and gasoline have leached out of the soil and into the groundwater.

Question from Grace Evans: What is a receptor?

Response by Greg: A receptor is anything that is at risk from a source of contamination through contact from skin exposure or ingestion (eating or drinking). Adult activities like smoking at contaminated sites are a form of hand-to-mouth exposure to the contamination. Also, children often eat dirt as they play on the ground.

Question from Lance Laughmiller: How readily do site-related contaminants leach?

Response by Greg: PAHs do not readily leach because they bind to the soil. Petroleum contamination in the subsurface soils has stayed there.

Question from Grace: Isn't that unusual?

Response by Gena Townsend: Components of gasoline can remain in subsurface areas for a long time, even years. Lance added that the degradation process can take decades to complete.

Comment from Pat McClellan-Green: You've indicated that the contamination is sporadic. Please explain.

Response by Greg: The contamination at Site 7 is not found throughout the site. Most of it is in one location. The benzene plume is beneath only part of the site.

Question from Alex Cardinell: What did you find is happening to the plume? Is it migrating or dissipating?

Response by Greg: In the well that has been sampled three or four times since 1991, levels have dropped. Samples from wells adjacent to Luke Rowe's Gut reveal no groundwater contamination and surface water samples from both Luke Rowe's Gut and Slocum Creek show no risk.

Question from Jane Sharpe, Grace's guest: Just how serious is it that you have found dioxin?

Response by Greg: Many types of dioxin exist. The kind found at OU3 contains high levels of chlorine, which are the less toxic form of dioxin. The levels found are below the unacceptable risk levels established by EPA and the State.

Question from Jane Sharpe: What is the risk to people who live and work on the Station?

Response by Greg: Human health risk assessments will be conducted for each operable unit. No overall assessment can be determined otherwise.

Question from Waverly Hampton: What about the PAHs discovered?

Response by Greg: PAHs are commonly found at locations wherever material has been burned.

Question from Grace: How many wells have been installed?

Response by Greg: There are 16 wells on either side of Luke Rowe's Gut.

Question from Rachel Johnson: What are ARARs?

Response by Greg: They are the federal and state regulations and guidance that must be complied with in determining how the site should be remediated.

Question from Alex: Does a facility exist that could treat the benzene?

Response by Greg: A soil venting process (like a vacuum) could be employed that would produce no dust. Air sparging or bio solve could be used to degrade the benzene.

Question from Alex: Is there a code to document the groundwater model you used? Our groundwater specialist was not familiar with it.

Response by Greg: Brown & Root combined a couple of models to create the one used for OU3. Matt Cochran added that Corry Rich had been dealing with Jody Eimers at USGS.

Question from Waverly: Did the ecological risk assessment look at the typical critters?

Response by Greg: A site visit revealed no stressed vegetation or wildlife at OU3. Although the ecological risk assessment evaluated the risk to ingesting fish, no fish samples have been taken.

Question from Alex: Are there any shellfish in Slocum Creek and could these shellfish be used as bioindicators?

Response by Grace and Pat: OU3 is located in closed water, which is not conducive to shellfish habitat. However, shellfish would be bioaccumulators and indicators of water and sediment contamination levels. Gena added that no fish samples were collected, consistent with EPA requirements. No risk-based concern was triggered by the results of the initial screening. If the screening results do not exceed the triggering level, no hard core sampling is necessary.

Pat pointed out that the fish that have died are not sediment dwellers.

Question from not recorded: Why was a treatment technology not picked as the preferred alternative?

Response by Greg: Lead is not mobile in the environment. Since the fence would prevent anyone from being exposed to the contaminated soil, no traditional technology was needed to meet the OU3 remediation objectives. The estimated fence cost is about $26,000 to construct, with maintenance of about $432,000 over 30 years. In contrast, alternative 7, the most aggressive of the alternatives evaluated, generated an estimated $2.6 million in construction costs. Even if all the soil was excavated, long-term monitoring would be required.

Question from Grace: Would it be worth planting biota such as the Indian mustard plant at OU3 to take up some of the metals?

Response by Greg: The location of the highest concentrations of lead is in that portion of Site 7 that is inaccessible and overgrown with vegetation. The flat area does not contain high lead levels.

Question from not recorded: Are you seeing any uptake of lead in local vegetation?

Response by Greg: That has not been evaluated.

Information generated as Pat asked a series of questions based on her review of the OU3 documents included:

Latex gloves are often the cause for phthalate ester detections during the laboratory analysis.

Signs will be placed along the edge of Luke Rowe's Gut and Slocum Creek.

Language in the ROD will need to be approved by the State in order to ensure that the benzene remaining in soil locations is guaranteed to be addressed.

More surface water samples will be taken at Site 7 around the flat area.

The work at Site 6 is not being done because of any risk, but rather as a part of general maintenance.

Jay Bassett was introduced. Jay will be succeeding Gena as EPA's Remedial Project Manger for MCAS Cherry Point. He has worked for EPA for 6 years, preceded by work for the Navy. Jay begins as EPA's RPM on August 23.

The next RAB meeting will be scheduled for sometime in October. [At the Partnering meeting the following morning, a decision was made to tie the next RAB meeting to the date and location of the next Partnering meeting. The October Partnering meeting is scheduled for October 8 at the Hampton Inn in Morehead City.]